AN ARITHMETIC OF CITIZENSHIP

BY

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2s.

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AN ARITHMETIC OF CITIZENSHIP

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PREFATORY NOTE

No apology is needed at the present time for producing a book which is a serious attempt to link up the arithmetical teaching in school with the actual problems of social life. All the problems dealt with in this book are of practical importance to a citizen, and none of them can be understood or thought of satisfactorily except in terms of number and numerical calculation. Each class of problem has been regarded as being, in the first place, a matter of sufficient interest in itself to be discussed and explained; the working of examples then becomes necessary, because of the inadequacy of words alone to give a thorough understanding and mastery.

It is expected that the book will prove useful in the upper classes of elementary schools and the middle classes of secondary schools. The following list of contents makes the plan of the book quite clear.

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ARITHMETIC OF CITIZENSHIP

CHAPTER I

WORK AND WAGES

1. Wages and Salaries.—The money that a man receives in payment for his work is generally called either his *wages* or his *salary*. We call it a salary when his pay is stated as being so much a year. Salaries are usually paid monthly or quarterly. Most workers, however, are paid wages every week.

2. Time Rates.—The simplest and most general method of paying wages is according to a *time rate*. That is to say, a man is paid a fixed sum per hour, day, or week. If the payment is so much per day or week, each of these is understood to consist of a definite number of working hours.

Whether wages be paid by the hour, day, month, or year, it is in every case necessary to be able to express the earnings as both a weekly and an annual amount. Income Tax (see Chapter XII.) is calculated on the annual wages, while the amount of money we permit ourselves to spend (see Chapter II.) is usually determined by an estimate of our weekly earnings.

Example I.—A man's wages are £3 8*s*. 6*d*. per week. How much does he earn in a year?

In 1 week he earns £3 8*s*. 6*d*.
∴ In 52 weeks he earns £3 8*s*. 6*d*. × 52 = £178 2*s*. 0*d*.

Example II.—A man's salary is £20 11*s*. 8*d*. per calendar month. What are his weekly wages?

Salary for 1 calendar month = £20 11*s*. 8*d*.
∴ Salary for 3 calendar months = £20 11*s*. 8*d*. × 3 = £61 15*s*. 0*d*.
3 calendar months = 13 weeks.
∴ Wages for 1 week = £61 15*s*. 0*d*. ÷ 13 = £4 15*s*. 0*d*.

3. Hourly Rates.—If a man is paid by the hour, it is quite an easy matter to calculate his earnings per week, provided we

know the number of hours he has worked and the hourly rate of pay.

Example.—A labourer is paid at the rate of 1*s.* 5*d.* per hour. How much does he earn during a week in which he works 43 hours ?

In 1 hour he earns 1*s.* 5*d.*

∴ In 43 hours he earns 1*s.* 5*d.* × 43
= (1*s.* × 43) + (5*d.* × 43)
= £2 3*s.* 0*d.* + 17*s.* 11*d.* = £3 0*s.* 11*d.*

Exercise 1.

1. (Mental.) Write down the yearly earnings corresponding to 1*s.*, 2*s.*, 5*s.*, 10*s.*, £1, £2, and £5 per week.

2. (Mental.) Write down the amounts per week corresponding to £52, £13, £104, £26, and £5 4*s.* 0*d.* per year.

3. What are the amounts earned yearly by men and boys whose weekly wages are: (*a*) £2 17*s.* 6*d.*; (*b*) £4 6*s.* 0*d.*; (*c*) £3 7*s.* 6*d.*; (*d*) £5 10*s.* 0*d.*; (*e*) 15*s.* 6*d.*; (*f*) £1 2*s.* 0*d.* ?

4. Calculate the wages due in the following cases: (*a*) 45 hours at 2*s.* 3*d.* per hour; (*b*) 35 hours at 1*s.* 11*d.* per hour; (*c*) 41 hours at 1*s.* 9*d.* per hour; (*d*) 37 hours at 2*s.* 7*d.* per hour.

5. Find the weekly wages of men whose annual salaries are (*a*) £130; (*b*) £221; (*c*) £195.

6. Find the weekly wages of men whose salaries per calendar month are (*a*) £12 18*s.* 11*d.*; (*b*) £14 7*s.* 1*d.*; (*c*) £18 2*s.* 11*d.*

7. A man is offered two posts. For one of these the salary offered is £234 per year. For the other, the wages are £4 7*s.* 6*d.* per week. Which is the better pay, and by how much a week ?

8. A man earns £3 5*s.* 0*d.* per week and saves £29 18*s.* 0*d.* in a year. How much does he spend per week ?

9. A grocer employs in his shop a manager whose wages are £4 15*s.* per week, an assistant whose wages are £3 5*s.* 6*d.* per week, and two boys to each of whom he pays 18 shillings a week. What is his total wages bill per annum ?

10. A man earns £2 7*s.* 6*d.* a week for the first 29 weeks of the year and £2 15*s.* 6*d.* per week for the rest of the year. How much does he earn altogether during the twelve months ?

4. Short Time.—Almost every trade has its slack and busy seasons. During the slack weeks of the year it is the custom in many trades, instead of discharging a certain number of workers, for everybody to work on *short time.* Thus, instead of a full 48-hour week, workers may be employed for 44 hours or even less.

The usual practice in reckoning wages in such cases is to pay the same *hourly rate* for short time as for full time.

Example.—The ordinary wage paid to men in a certain factory is £3 10*s.* 0*d.* per week of 48 hours. Find the wages that would be paid for a short week of 43 hours.

Wages for 48 hours $=$ £3 10s. 0d.

$$\text{Hourly rate} = \frac{£3\ 10s.\ 0d.}{48} = 1s.\ 5\tfrac{1}{2}d.$$

$\therefore$ Wages for 43 hours $= 1s.\ 5\frac{1}{2}d. \times 43$

$= 43s. + 17s.\ 11d. + 1s.\ 9\frac{1}{2}d.$

$= £3\ 2s.\ 8\frac{1}{2}d.$

Exercise 2.

1. The hours of a factory are as follows: Monday, 10 a.m. to 6 p.m.; Tuesday and Wednesday, 8 a.m. to 6.30 p.m.; Thursday and Friday, 8 a.m. to 6 p.m.; Saturday, 8 a.m. to 1 p.m. Dinner-time is from 1 p.m. to 2 p.m. on every day except Saturday. What is the number of hours worked during the week ?

2. During a certain week a factory worked from Monday to Friday, the hours being 8 a.m. to 1 p.m. in the morning and 2 p.m. to 5.30 p.m. in the afternoon. What was the number of hours worked ?

3. What are the hourly rates of pay of workers whose standard rates are (*a*) £1 19*s*. 0*d*. for 48 hours; (*b*) £1 18*s*. 6*d*. for 44 hours; (*c*) £1 2*s*. 9*d*. for 42 hours; (*d*) £2 5*s*. 0*d*. for 40 hours ?

4. Find the wages for a 38-hour week of workers whose standard rates are (*a*) £3 for 48 hours; (*b*) £3 15*s*. 0*d*. for 40 hours; (*c*) £1 13*s*. 0*d*. for 44 hours; (*d*) 17*s*. 6*d*. for 42 hours.

5. In a certain year a man worked 10 weeks of short time. Four of these were 44-hour weeks, and the other six were 40-hour weeks. During the rest of the year he worked full time, his weekly wages being 36*s*. for a 48-hour week. Find his total earnings during the year.

6. A worker is paid £1 15*s*. 0*d*. for a normal week of 40 hours. He loses $\frac{1}{2}$ hour through lateness upon each of four mornings during the week. What wages will he receive ?

7. How much less than his ordinary wages does a man receive who works a 38-hour week, if his rate of pay is £2 5*s*. 0*d*. for a 48-hour week ?

8. A woman's wages are £1 12*s*. 0*d*. for a 48-hour week. How many hours did she work in weeks for which her wages were (*a*) £1 4*s*. 0*d*.; (*b*) £1 10*s*. 0*d*.; (*c*) £1 8*s*. 8*d*. ?

9. The wages paid by a factory during a full week of 48 hours amount to £163 4*s*. 0*d*. What would you expect its wages bill to be for a 36-hour week during slack time ?

10. During a short 40-hour week the wages in a certain factory are £85 6*s*. 8*d*. What would their wages be for a full 44-hour week ?

5. Overtime.—During the busy part of the year it is often necessary to work overtime. The extra hours are usually paid for at a higher rate than that paid for ordinary time.

When a man receives a weekly wage, it is sometimes part of his agreement that he will be paid for all his overtime at a certain fixed rate. For example, if he earns £3 per week, it may be agreed to pay him 1*s*. 6*d*. an hour for overtime.

Example.—A man is paid £3 a week and 1*s.* 6*d.* per hour overtime. In one week he works 7 hours' overtime. What are his total wages ?

	£	s.	d.
For the week's ordinary work he receives	3	0	0
For 7 hours' overtime he receives $7 \times 1s.\ 6d. =$	0	10	6
∴ His total wages will be	£3	10	6

It is more usual, however, for a man to be paid a fixed fraction more than his ordinary pay for overtime work. For instance, we sometimes say that a man is paid time and a half for overtime work. This means that he is paid for each hour as if it were an hour and a half. So if he is paid 1*s.* an hour for ordinary work, he will get 1*s.* 6*d.* an hour for overtime. If his overtime rate is time and a quarter, he will get 1*s.* 3*d.* an hour; while if it is double time, he will get 2*s.* an hour.

Example.—A man earns £3 6*s.* 0*d.* per week of 44 hours. He is paid overtime at the rate of time and a third. He works 9 hours' overtime in a week. Find his total wages.

In 44 hours he earns £3 6*s.* 0*d.* = 66*s.*

$$\therefore \text{ In 1 hour he earns } \frac{66s.}{44} = 1s.\ 6d.$$

Overtime rate $= 1\frac{1}{3} \times 1s.\ 6d. = 2s.$ per hour.

	£	s.	d.
For the week's ordinary work he receives	3	6	0
For 9 hours' overtime at 2*s.* he receives	0	18	0
∴ Total wages =	£4	4	0

6. **Special Overtime Rates.**—In addition to the ordinary overtime rate of pay, a man is often paid a *special overtime rate* when he works more than a certain number of hours of overtime in a single day. A special overtime rate is also frequently the rule for work on Sundays or Bank Holidays. The following example will make this point clear:

Example.—A man's standing wage is £2 15*s.* 0*d.* for a week of 44 hours. He is paid for his overtime at the rates of:

(*a*) Time and a half for the first 4 hours each week-day.

(*b*) Double time for all overtime after 4 hours on a week-day, and also for all work on Sundays.

In one week, in addition to his ordinary 44 hours, he works overtime for 5 hours on Sunday, 2 hours on Tuesday, and 5 hours on Thursday. What are his total earnings ?

$$\text{Wages for 44 hours} = £2\ 15s.\ 0d.$$

$$\therefore \text{ Wages for 1 hour} = \frac{55s.}{44} = 1s.\ 3d.$$

Overtime :

Sunday—5 hours' double time	=10	hours'	ordinary	time.
Tuesday—2 hours' time and a half	= 3	,,	,,	,,
Thursday—4 hours' time and a half	= 6	,,	,,	,,
Thursday—1 hour double time	= 2	,,	,,	,,
Total overtime	=21	,,	,,	,,

$\therefore$ Pay for overtime $= 21 \times 1s.\ 3d. = 21s. + 5s.\ 3d. = £1\ 6s.\ 3d.$
$\therefore$ Total wages $= £2\ 15s.\ 0d. + £1\ 6s.\ 3d. = £4\ 1s.\ 3d.$

Exercise 3.

1. What are the hourly overtime rates at time and a third of workers whose standard rates for a 48-hour week are (*a*) £3; (*b*) £3 15*s*. 0*d*.; (*c*) 18*s*. 0*d*.?

2. Find the hourly overtime rates at time and a quarter for workers whose standard wages for a 40-hour week are (*a*) £4 10*s*. 0*d*.; (*b*) £3 10*s*. 0*d*.; (*c*) £1 10*s*. 0*d*. ?

3. A man works 54 hours in a certain week. His standard wage is £2 15*s*. 0*d*. for a 44-hour week. Overtime is paid at the rate of time and a half. What will he earn ?

4. Find the amount earned by a man who works 52 hours during a certain week, his wages being £3 8*s*. 0*d*. for a 48-hour week, and overtime being paid at time and a quarter.

5. A man's standard wage is £2 16*s*. 0*d*. for a 48-hour week. Overtime is paid at the rate of time and a half. How many hours' overtime did he work during weeks in which his total wages were (*a*) £3 4*s*. 9*d*.; (*b*) £3 8*s*. 3*d*.; (*c*) £3 17*s*. 0*d*. ?

6. A man's standard wage is £3 10*s*. 0*d*. for a 42-hour week. If he is paid for his overtime at the rate of time and a quarter, find the number of hours' overtime which he worked during weeks in which his total wages were (*a*) £4 0*s*. 5*d*.; (*b*) £4 8*s*. 9*d*.; (*c*) £3 14*s*. 2*d*.

7. A man is paid overtime as follows: Time and a half for the first 4 hours each day, and double time for all additional hours, as well as for Sunday work. Find the number of hours of ordinary work, the pay for which is the same as that for the following overtime: (*a*) Monday, 2 hours; Tuesday, 5 hours; Sunday, 7 hours; (*b*) Tuesday, 3 hours; Friday, 2 hours; (*c*) Wednesday, 6 hours; Sunday, 3 hours; (*d*) Monday, 1 hour; Tuesday, 1 hour; Sunday, 3 hours.

8. A man's wages are £2 13*s*. 4*d*. per 40-hour week. He is paid time and a quarter for the first 2 hours' overtime each weekday and time and a half for all additional overtime, including Sunday work. Find his total wages for weeks in which he worked the following overtime: (*a*) Sunday 4 hours, Monday 3 hours, Saturday 2 hours; (*b*) Monday 7 hours, Thursday 4 hours; (*c*) Tuesday 1 hour, Wednesday 1 hour, (*d*) Saturday 6 hours; (*e*) Wednesday 8 hours, Sunday 3 hours

7. Piece-Work.—Some men are paid according to the amount of work which they do instead of according to the number of hours they work. We say that such men are paid at *piece-rates*, and we call their work *piece-work*. In order that any kind of work may be paid for at piece-rates, it must, of course, be possible to measure easily the amount of work which has been done and to compare it with a certain standard or unit. Thus a bricklayer can be paid so much for every hundred bricks which he lays, and a collier so much for every ton of coal which he hews.

Example.—A bricklayer lays 2,250 bricks in a week. He is paid 3*s.* 6*d.* per 100 bricks. How much does he earn ?

For 100 bricks he earns 3*s.* 6*d.*

$\therefore$ For 2,250 bricks he will earn $22\frac{1}{2} \times$ 3*s.* 6*d.* = £3 18*s.* 9*d.*

8. Guaranteed Minimum Rates for Piece-Workers.—Payment by piece-rates may not always be quite fair to the worker. For instance, there may be special difficulties in his work upon certain days; or he may be kept waiting or hindered for various reasons. In order to overcome this difficulty, it is the custom to guarantee the piece-worker a minimum wage. The piece-worker then knows that he will not receive less than the guaranteed wage for a full week's work.

Example.—A compositor is paid 1*s.* 8*d.* per 1,000 "ens" for setting type of a certain size. He is guaranteed £5 per week of 40 hours. He works full time and sets 55,000 "ens." What will his wages be ?

For 1,000 "ens" he earns 1*s.* 8*d.*

$\therefore$ For 55,000 "ens" he earns $55 \times$ 1*s.* 8*d.* = £4 11*s.* 8*d.*

This is less than the guaranteed minimum.

$\therefore$ His wages will be £5.

Exercise 4.

1. A paper-hanger is paid according to the number of pieces of paper which he hangs. In 4 successive weeks he hangs the following number of pieces: (*a*) 17 pieces at 2*s.* 3*d.*, 14 pieces at 2*s.* 0*d.*, and 23 pieces at 1*s.* 10*d.*; (*b*) 57 pieces at 1*s.* 9*d.*; (*c*) 11 pieces at 3*s.* 3*d.*, and 24 pieces at 2*s.* 2*d.*; (*d*) 40 pieces at 1*s.* 11*d.* and 5 pieces at 2*s.* 1*d.* Find his wages for each week.

2. A piecework paper-hanger reckons to earn 2*s.* 3*d.* per hour. What should be the piece-rate for staircase paper which he can hang at the rate of 6 pieces per 8-hour day ?

3. A bricklayer is paid 4*s.* 9*d.* per 100 bricks he lays. (*a*) What are his wages for laying 1,650 bricks ? (*b*) How many bricks did he lay during a week in which he earned £4 10*s.* 3*d.* ?

4. Some years ago an American contractor, building a chimney for a huge electric power station, had men who could lay 3,000 bricks in an 8-hour day. (*a*) If the payment was 1*s*. 6*d*. per 100 bricks, find how much the men earned per hour. (*b*) What piece-rate per 100 bricks would secure a wage of 5*s*. 0*d*. per hour ?

5. A man who breaks stones for road metal is paid 4*s*. 6*d*. per cubic yard. (*a*) In a 40-hour week he breaks up 8 cubic yards. Find his hourly earnings to the nearest penny. (*b*) How many cubic yards must he break per week of 45 hours if he wishes to earn 7½*d*. per hour ?

6. A firewood merchant pays his men 1*s*. 3*d*. per 100 bundles chopped and tied. (*a*) Find the weekly earnings of a man who chops and ties 5,000 bundles. (*b*) How long should it take a man to complete a single bundle if he wishes to earn 1 shilling per hour ? (*c*) How many bundles does a man chop in a week during which he earns £3 12*s*. 6*d*. ? (*d*) What wages must the merchant be prepared to pay to have 40,000 bundles chopped ?

7. A man is paid 1*s*. 2*d*. a ton for unloading coal. How many tons must he unload per 8-hour day if he wishes to earn £3 17*s*. 0*d*. in a 44-hour week ?

8. A shirt-ironer is guaranteed a minimum rate of 9½*d*. per hour, the piece-rate being 1*s*. 6*d*. per dozen shirts. Find the wages of a shirt-ironer who (*a*) works 40 hours and irons 330 shirts; (*b*) works 48 hours and irons 230 shirts; and (*c*) works 36 hours and irons 312 shirts.

9. National Health, Pensions and Unemployment Insurance.—In the cases of most workers, there are two contributions which the employer has the right to stop from the wages every week.

The first of these is the contribution for *National Health and Pensions Insurance*. All manual workers (and all other workers who earn less than £250 per year) are compelled to pay a certain sum every week for Health and Pensions Insurance. The employer makes a further contribution. Every male worker over 16 has to pay 9*d*. a week, and his employer an additional 9*d*., making 1*s*. 6*d*. a week in all. The employer buys special stamps from the Post Office and fixes them on the insurance cards of his work-people. He is then entitled to deduct 9*d*. a week from each man's wages as the man's contribution. Similar contributions are paid by women workers and their employers.

In the same way under the Unemployment Insurance Acts, the same workers (with a few exceptions, such as domestic servants and agricultural workers) must pay a weekly contribution for *Unemployment Insurance*. The employer also has to make a weekly contribution. In the case of men, according to the 1927 Act of Parliament, the worker pays 7*d*. and the employer 8*d*. per week. The employer accordingly has to put a 1*s*. 3*d*. stamp on each man's card every week, and he is allowed to deduct 7*d*. a week from the man's wages, while he pays the other 8*d*. himself.

The benefits which the worker receives from these Insurances will be explained in Chapter IV. At present we are referring to them only as deductions which are made from wages.

The following tables show the contributions which have to be made by employers and employees in the cases of women, boys and girls, as well as men, for these two Insurances.

TABLE I.—HEALTH AND PENSIONS INSURANCE CONTRIBUTIONS.

Class of Worker.	*Worker's Contribution.*	*Employer's Contribution.*	*Total Contribution.*
Male workers over 16 ..	9*d.*	9*d.*	1*s.* 6*d.*
Female ,, ,, 16 ..	6*d.*	7*d.*	1*s.* 1*d.*

Note.—Special contributions apply to workers in low-paid industries.

(*a*) Where the wage of a worker of 18 years of age or over is not more than 3*s.* a day the contribution payable by the worker for Health and Pensions Insurance is only 4½*d.* per week for men and 2*d.* per week for women (*this being the amount of the Pensions contribution*). The remainder is paid by the employer.

(*b*) Where the wage is more than 3*s.* a day, but not more than 4*s.* a day, the worker's contribution is 8*d.* for men and 5*d.* for women, the employer being responsible for the remainder.

TABLE II.—UNEMPLOYMENT INSURANCE CONTRIBUTIONS.

Class of Worker.	*Worker's Contribution.*	*Employer's Contribution.*	*Total Contribution.*
Men (21 to 65) ..	7*d.*	8*d.*	1*s.* 3*d.*
Women (21 to 65) ..	6*d.*	7*d.*	1*s.* 1*d.*
Young men (18 to 20) ..	6*d.*	7*d.*	1*s.* 1*d.*
Young women (18 to 20) ..	5*d.*	6*d.*	11*d.*
Boys aged 16 and 17 ..	3½*d.*	4*d.*	7½*d.*
Girls aged 16 and 17 ..	3*d.*	3½*d.*	6½*d.*

Example.—A painter earns £3 15*s.* 0*d.* in a week. He pays Health and Unemployment Insurance contributions. How much money will he receive after his cards have been stamped ?

		£	s.	d.
Wages		3	15	0
Health and Pensions Insurance	= 9*d.*			
Unemployment Insurance	= 7*d.*			
		0	1	4
∴ He will receive		£3	13	8

Exercise 5.

Note.—Assume in the following exercise that all workers pay the full contribution for Health and Pensions Insurance.

1. Write down the total contribution for Health, Pensions and Unemployment Insurance paid by (*a*) boys of 17; (*b*) girls of 17; (*c*) men; (*d*) women.
2. A boy of 16 is paid at the rate of 4½*d.* per hour, and works 46 hours in a week. Find his wages after deducting Health, Pensions and Unemployment Insurance contributions.
3. A woman's wage is 32 shillings for a 48-hour week. What amount will she actually receive after working a 42-hour week ?
4. A man is paid 1 shilling per ton for unloading potatoes. If he unloads 72½ tons in a week, what wage will he actually be paid ?
5. After working an ordinary 44-hour week, a man is paid £2 10*s.* 0*d.*, after deducting insurances. What is his rate of pay per hour ?
6. A boy aged 18 works a short week of 33 hours and is paid 18*s.* 0*d.*, after deducting Health, Pensions and Unemployment Insurance contributions. What is his full rate of pay for a 48-hour week before deducting these contributions ?

Exercise 6.

Miscellaneous.

Note.—In the following examples, no deductions should be made from wages for National Health, Pensions and Unemployment Insurance contributions, unless this is particularly asked for.

1. An employer has working for him 130 men whose normal week consists of 44 hours. What saving per week will he make if their wages are reduced by 1½*d.* per hour ?
2. A firm employs 70 men and 32 boys. During a particular year their rates of pay are reduced by 4*d.* per hour in the case of the men

and $1\frac{1}{2}d$. per hour in the case of the boys. Calculate the annual reduction in the wages bill of the firm, taking a 42-hour week as the standard.

3. Which is the better paid post, one paid at a salary of £130 per year, or one the wages for which are £2 9*s*. 0*d*. per week ?

4. A man earns £2 17*s*. 6*d*. per week and saves £45 10*s*. 0*d*. in a year. How much does he spend per week ?

5. A man earns £3 2*s*. 6*d*. for 24 weeks, at the end of which time he leaves his employment. He then has three weeks' holiday, after which he works for the rest of the year at a wage of £3 10*s*. 0*d*. per week. Find his total earnings during the year.

6. Find the weekly wages of a man who is paid £60 2*s*. 6*d*. per quarter.

7. A man is paid £15 14*s*. 2*d*. per calendar month. How much is this per week ?

8. During a certain week a factory worked from Monday to Thursday, the hours of work being from 8 a.m. to 6 p.m., with one hour for dinner. Find the number of hours worked during the week.

9. What are the hourly rates of pay of workers whose standard rates are: (*a*) £3 17*s*. 0*d*. for 44 hours; (*b*) 13*s*. for 48 hours; (*c*) £1 16*s*. 8*d*. for 40 hours ?

10. A man's wages for a particular week were £2 8*s*. 9*d*. How many hours did he work, if his ordinary wages are £2 15*s*. 0*d*. for a 44-hour week ?

11. Find the amount due to a man for 8 hours' overtime, if his standing wage is £3 4*s*. 0*d*. for 48 hours and overtime is paid for at the rate of time and a half.

12. How much will a man earn in a 50-hour week, if his standard wage is £3 6*s*. 0*d*. for a 44-hour week, and overtime is paid for at the rate of time and a third ?

13. A man is paid at the rate of 1*s*. 5*d*. per hour for a 42-hour working week. Find his total wages for a 50-hour week, if he is paid for overtime at the rate of time and a quarter.

14. A man is paid time and a half for all overtime on weekdays and double time for all work on Sundays. If his ordinary rate of pay is 1*s*. 4*d*. per hour, how much will he be paid for overtime during a week in which he worked the following extra hours: Tuesday, 3 hours; Thursday, 2 hours; Sunday, 4 hours ?

15. A bricklayer wishes to earn 2*s*. 6*d*. per hour. How many bricks must he lay in a 9-hour day, if the piece-rate is 1*s*. 6*d*. per 100 bricks ?

16. A miner is paid at the rate of 12*s*. 11*d*. per "shift" of 8 hours. Find his average weekly wage, if he works 11 shifts per fortnight.

17. How many bags of cement are unloaded per hour by a gang of four men who earn £5 5*s*. 0*d*. each during a 30-hour week, the piece-rate being 2*d*. per dozen bags unloaded ?

18. A man can earn 1*s*. 6*d*. per hour when packing oranges, the piece-rate being 2*d*. per box. (*a*) How many boxes will he pack in an 8-hour day ? (*b*) How many oranges will he pack per minute, if each box contains 160 oranges ?

19. A man is paid at the rate of 1*s*. 8*d*. per hour and works 43 hours

in a week. What wages will he actually receive, after the deduction of contributions for Health, Pensions and Unemployment Insurance ?

20. A man's wage is £3 16*s.* 0*d.* for a 48-hour week. What amount will he actually be paid for a 40-hour week, after deducting the Health, Pensions and Unemployment Insurance contributions ?

CHAPTER II

THE FAMILY BUDGET

10. Income and Expenditure.—Most people understand the word " budget " to mean one particular kind of budget—the National Budget. This is indeed the most important budget, because it affects everybody in the land. The whole of Chapter XV. will be given up to explaining it. We shall probably understand it better after considering the simple but important *family budget* which is the subject of the present chapter.

The last chapter was about the earning of wages. The family budget has to do with the way in which it is proposed to spend them.

Suppose a boy earns £1 2*s.* 0*d.* a week, and decides to keep an account of how he spends his money. The first week's record may be something like the following:

Income.	£	*s.*	*d.*	*Expenditure.*	£	*s.*	*d.*
Wages	1	2	0	Paid at home ..	0	12	0
				Fares (6 days) ..	0	1	6
				Meals bought ..	0	4	6
				Amusements ..	0	1	8
				Odd expenses ..	0	2	4
				Total ..	£1	2	0

This is a simple record of past income and expenditure, and the two sides of the account have been made to balance. In this case the boy spent all the money he earned.

It is possible, however, that he may not be satisfied with what he has done. For example, he may wish to save a certain sum of money each week. The only satisfactory way for him to make sure of being able to do this is for him to *decide beforehand* what he is going to do with his money, how much he is going to spend, and in what way. He must look over the record and prepare an *estimated account* for future weeks. Such an estimate is

what we call a *budget*. In his budget, the boy will cut certain expenses down so as to leave the desired sum of money in hand at the end of the week. The following is his possible budget, if he wishes to save 2*s*. 6*d*. a week. We will only give the expenditure side.

	£	*s*.	*d*.
Amount to pay at home	0	12	0
Fares (6 days)	0	1	6
Meals	0	3	6
Amusements	0	0	8
Odd expenses	0	1	10
Left over for saving	0	2	6
Total ..	£1	2	0

11. The Family Budget.—A similar budget can be drawn up as an estimate of the income and expenditure of every home. Suppose the boy we have just mentioned is living at home, and that, in addition to his own contribution of 12*s*. a week, his father is earning £3 10*s*. 0*d*. per week. The family budget may then be as follows:

Income.	£	*s*.	*d*.	*Expenditure.*	£	*s*.	*d*.
Father's wages ..	3	10	0	Rent and rates ..	0	12	6
Paid by son ..	0	12	0	Food and household expenses	1	19	0
				Fuel and light ..	0	5	0
				Clothing	0	6	0
				Insurances and sick clubs	0	3	0
				Holidays	0	5	0
				Personal expenses of father	0	11	6
Total income ..	£4	2	0	Total expenditure	£4	2	0

The various items of expenditure in this budget are those which occur in every family budget, whether the family income be large or small.

The first thing we have to notice is that not all these expenses have to be met every week. It does not follow, for instance, because we have allotted 6*s*. a week for clothing, that 6*s*. will actually be spent every week for this purpose. Nor does it mean that 6*s*. will be put aside each week to pay for clothing when it becomes necessary to buy the next new suit or pair of boots. What actually happens is as follows:

(*a*) Every possible item of expenditure is included in the budget, because this is the only way of making quite certain that the expenditure will be kept within the limits of the family income.

(*b*) The expenses that have to be met weekly are kept within the amounts allowed in the budget. Such expenses would be rent (if it is paid weekly); food and household expenses (which include such things as soap and cleaning materials); gas (if there is a slot meter); insurances and sick clubs; and the father's personal expenses.

(*c*) The balance is put by. It will then happen, possibly, that all the savings are used one week to pay for fuel, another week to buy clothing, and so on. When this is done, however, it must be remembered that the average amount spent weekly on any one item must not be allowed to exceed the sum set apart in the Family Budget. Provided that all expenditure is kept to the estimated figure or below it, there will always be money to meet expenses that become due from time to time.

(*d*) Should the family income be reduced at any time (because, for example, the father is working short time, or the son is out of work), it becomes necessary immediately to revise the budget. The expenditure on certain items must be reduced at once so as to make the two sides balance. Only in this way can a man make certain that he is going to live "within his income"—that is to say, that he is not going to spend more money on any one item than he can afford.

Exercise 7.

1. A boy has 40 weeks in which to save up for a week's holiday. If his fare is to cost him 10*s.* 4*d.*, his lodgings £1 12*s.* 0*d.*, and he wishes to allow himself for other expenses 7 shillings a day for 6 days, how much must he save per week, supposing that he will be paid his usual wages of 21 shillings for his holiday week?

2. A housewife burns 2 tons of coal per year. How much must she set aside in her weekly budget, if coal is 45*s.* 6*d.* per ton?

3. How much must a worker save per week for his railway season ticket, if this is to cost him (*a*) £1 9*s.* 3*d.* per quarter; (*b*) £1 11*s.* 5*d.* per half-year; (*c*) 10*s.* 10*d.* per calendar month? [In the last example it will be necessary first to find the cost per quarter.]

4. A boy has to buy his own clothes, and estimates that during the year he will need a new suit at £2, one pair of boots at 15*s.* and a cheaper pair at 8*s.* 6*d.*, shirts and collars to cost 12*s.* 6*d.*, a cap at 3*s.*, and underclothing to cost 12*s.* How much should be put aside each week?

5. A man who pays 7*d.* a day fares on 6 days a week decides to buy a second-hand bicycle for £2 10*s.* 0*d.* If his tyres and other expenses cost him £1 7*s.* 6*d.* per year, what will he save in fares during the first year, assuming that he pays the initial cost of the bicycle during that time?

6. How much must be set aside per week to meet the following Life Insurance premiums: (*a*) 17*s*. 4*d*. per quarter; (*b*) £1 4*s*. 11*d*. per half-year; (*c*) £2 1*s*. 2*d*. per year?

7. How much must be reckoned weekly for gas and fuel, if the previous year's quarterly gas bills were £1 9*s*. 6*d*., £1 0*s*. 3*d*., 18*s*. 2*d*., and £1 2*s*. 9*d*., and it is expected to burn $1\frac{1}{2}$ tons of coal at 45 shillings per ton?

8. A man whose bus fares to and from work cost him 10*d*. per day, for 6 days of each week, decides to travel by train and purchases a season ticket which costs him £1 15*s*. 6*d*. per quarter. How much will he save in a year?

9. A man who travels to and from work by train finds that the ordinary return fare is 9*d*., while the workman's ticket for the double journey, available for the early morning trains, is only 5*d*. How much will he save in a year by travelling sufficiently early for a workman's ticket, if he travels 6 days a week for 50 weeks of the year?

10. A man buys a piano the price of which is 68 guineas. He pays a deposit of £9 and agrees to pay the remainder by quarterly instalments spread over 3 years. Find (*a*) the amount he will be required to pay per quarter, and (*b*) the sum he should set aside each week to meet the instalments when they become due.

CHAPTER III

RENT AND RATES

12. Separate Payment.—"Rent and Rates" was the first item on the expenditure side of the family budget in the last chapter. The simplest way to understand the difference between rent and rates, and their relation to each other, will be to consider first the case of a fairly large house, the tenant of which has to pay his rent and rates separately.

13. Rent.—Let us suppose that a man takes a house at a rent of £60 per annum. This rent is the money that the tenant has to pay to the landlord to whom the house belongs. In return for the rent, the landlord will not only allow the tenant to live in the house, but also he will usually guarantee to keep the house in good repair.

The rent for such a house will generally be paid quarterly, and the payments will fall due on what are known as the *quarter days*—Lady Day, March 25; Midsummer Day, June 24; Michaelmas, September 29; and Christmas Day, December 25.

14. Rates.—But the rent is not the only payment which the tenant will be called upon to make. He will also be required to

pay what are called *Rates.** A later chapter will explain fully all the purposes for which the money paid as rates is required.

All that we need to realize at present is that, particularly if we live in a large town or city, there are many expenses which somebody must meet if our comfort and health and safety are to be ensured. For instance, the streets must be kept clean and lighted. No doubt, one way of doing this would be for everybody to keep his own part of the street swept (although even then someone would have to remove the sweepings), and for every house to provide a light shining out on the street.

This would be too expensive. What actually happens is that in every district there is what is called the *local authority* which looks after these things for us. The local authority may be a County Council, a Borough Council, an Urban District Council, or a Rural District Council, according to the district in which the house is situated. This Council is responsible for paying policemen and firemen to keep us safe; dustmen, sewer-men, and Medical Officers of Health to keep us healthy; and teachers and librarians for our schools and libraries.

All these things cost money, and the rates we pay are our share of the cost.

15. Assessment.—The money spent by the local authority has to be paid by the inhabitants of the district. It is necessary, however, to make certain that everyone pays his proper share. This is done by sharing the total cost among the houses in the district and collecting a fair proportion from every householder.

The amount of rates payable by each householder depends upon the size of the house in which he lives and its annual value. From time to time all the houses in each district are *assessed*. Particulars are obtained of the number of rooms in the house, the rent received by the landlord, and the cost of repairs. A special committee of the local authority then decides what the annual value of the house really is—that is to say, what the net rent is that the landlord receives, after he has paid for repairs.

Roughly, we may take the assessment to be *five-sixths of the rent* paid by the tenant, the remaining one-sixth being the estimated average cost of repairs. So if the rent paid for a house is £60 per year, the assessment of its annual value would be £50. This assessment is also called the *rateable value* of the house.

Factories and business premises are also included in the assessment and have to pay rates according to their rateable value.

* Besides what are ordinarily called "rates," there is sometimes a separate "water rate," which has to be paid by the person who agrees to pay the "rates." In our examples we assume the water rate to be included in the general rate.

Example I.—The rent of a house (exclusive of rates) is 12*s.* per week. If an allowance of one-sixth is made for repairs, what should be the annual assessment of the house for rates ?

$$\begin{aligned} &\text{Rent for one week} &&= 12 \text{ shillings.}\\ &\text{Repairs for one week} &&= \underline{\ 2 \quad\ \ ,,\quad}\\ \therefore\ &\text{Assessment for one week} &&= 10 \quad\ ,,\\ &\text{Annual assessment} &&= 52 \times 10s. = £26. \end{aligned}$$

Example II.—Find the assessment of a house the annual rent of which is £45.

$$\text{Assessment} = \tfrac{5}{6} \text{ of } £45 = \frac{£5 \times 15}{2} = £37\ 10s.$$

Example III.—What should the rent (exclusive of rates) be of a house assessed at £25 10*s.* ?

$$\begin{aligned} &\text{Assessment} = \tfrac{5}{6} \text{ rent} &&= £25\ 10s.\\ \therefore\ &\text{Annual rent} &&= \tfrac{6}{5} \times £25\ 10s.\\ & &&= 6 \times £5\ 2s. = £30\ 12s. \end{aligned}$$

Exercise 8.

(*In the following examples the assessment should be taken as* $\frac{5}{6}$ *of rent.*)

1. What would you expect the assessments of houses to be the annual rents of which are (*a*) £120; (*b*) £63; (*c*) £75; (*d*) £36 ?

2. What would you expect the annual rents (exclusive of rates) to be of houses assessed at (*a*) £17 10*s.*; (*b*) £25; (*c*) £37 10*s.*; (*d*) £31 5*s.* ?

3. Calculate the annual assessments of houses the weekly rents (apart from rates) of which are (*a*) 18*s.*; (*b*) 16*s.* 6*d.*; (*c*) 13*s.* 6*d.*; (*d*) £1 1*s.*

4. Find the annual assessments of houses the rents (exclusive of rates) of which per calendar month are (*a*) £2 2*s.*; (*b*) £1 15*s.*; (*c*) £3 10*s.*; (*d*) £1 8*s.*

16. How Rates are Charged.—When all the houses (and other premises) have been valued in this way, it is quite a simple matter to divide the district expenses among them. Suppose, for example, that the total rateable value of a district is £40,000, and that the estimated district expenses for 6 months are £10,000. This sum of money would be raised if each householder paid a quarter of the rateable value of his house. This is usually expressed by saying that the rates would be 5*s.* in the £ for the half-year.

One of the simplest ways in which we can grasp the real meaning of the rateable value of the district in which we live, is to consider what amount would be raised by an extra rate of 1*d.* in the £ on the whole district. This amount is often spoken of as the product of a penny rate. Such a rate in a district of rateable value £160,000 would produce 160,000*d.*, or £666 13*s.* 4*d.*

Example I.—A house is assessed at £30. The rates for the year are 12s. 6*d.* in the £. How much will the rates amount to ?

On £1 the rates are 12*s.* 6*d.*

∴ On £30 the rates are 12*s.* 6*d.* $\times$ 30 = £18 15*s.*

Example II.—Find the product of a 2*d.* rate in a borough the rateable value of which is £27,500.

A 2*d.* rate will produce 27,500 $\times$ 2*d.* = 55,000*d.* = £229 3*s.* 4*d.*

Exercise 9.

Note.—When calculating rates, take the assessment as five-sixths of the annual rent.

1. The total property in a borough is assessed at £105,000. What rate must be levied in the £ to raise (*a*) £21,000; (*b*) £44,625 ?

2. What will be produced by a 1*d.* rate in each of the following London boroughs: (*a*) City of London, rateable value £5,880,000; (*b*) Chelsea, rateable value £927,000; (*c*) Stoke Newington, rateable value £336,000 ?

3. The rateable value of Gloucester is £287,000. How much would be produced by a rate of 5*s.* in the £ ?

4. Find the rates at 7*s.* 8*d.* in the £ payable on houses assessed at (*a*) £22 10*s.*; (*b*) £44; (*c*) £50.

5. What rates at 8*s.* 6*d.* in the £ would be payable on houses the rents of which were (*a*) £72; (*b*) £99; (*c*) £39 per annum ?

6. Find the total rent and rates payable yearly by the tenant of a house at £30 rent, standing in a district rated at 18*s.* 6*d.* in the £ per annum.

7. A man rents a house at £42 per year. It is assessed at £35 and he pays rates at 14*s.* in the £ per annum. He sublets one floor of his house for 17*s.* 6*d.* per week. What does the remainder of the house cost him for rent and rates per annum ?

8. If a man tells you that his rates for the half-year amounted to £10 4*s.*, and then adds that they were 8*s.* 6*d.* in the £, find (*a*) the assessment, and (*b*) the rent of his house.

9. Which is cheaper, a house at £72 per year rent in a district with rates at 12*s.* in the £, or one at £66 per year rent in a district where the rates are 14*s.* 6*d.* in the £ ?

10. A man who formerly paid 17*s.* per week rent (including rates) decides to take on a house at £30 rent (excluding rates) in a district where the rates are 15*s.* 6*d.* in the £ per annum. How much more will his new house cost him per year than his old one did ?

17. Inclusion of Rates in Rent.—Instead of paying rent and rates separately (the rent to the landlord and the rates to the local authority), it sometimes happens that the amount paid to the landlord includes rates as well as rent. When this is so, the landlord has to pay the rates himself out of the money which the tenant pays him.

It must be clearly understood, however, that even when the landlord pays the rates, the money still comes out of the tenant's pocket. Suppose a landlord owns two houses of the same size, which he lets to two different tenants. Suppose also that one tenant pays his own rates, while the landlord pays the rates of the other house. If the rent of the first house is 10*s.* a week, and the tenant pays his own rates of 7*s.* a week, then the rent of the second house must include rates, and will equal 17*s.* a week.

The only difference in the two cases will be that the first tenant will pay his 10*s.* a week rent and will pay the rates quarterly or half-yearly; while the second tenant will pay the whole 17*s.* every week. It is so much more convenient for many people to pay the majority of their expenses weekly that it is very general for the rents of small houses to be paid weekly, and to include the rates.

We can see that, in such cases, the rent figure really equals rent + rates by the fact that if the rates are increased, the landlord increases the rent figure to the same extent.

Example.—A landlord estimates the weekly value of his house to be 8*s.* 6*d.* The rateable value is £18 and the rates are 15*s.* 2*d.* in the £. How much should the landlord charge per week if he wishes the rent to include rates?

$$\begin{aligned} &\text{Rates per year} &&= 18 \times 15s.\ 2d. = £13\ 13s. \\ \therefore\ &\text{Rates for one week} &&= £13\ 13s. \div 52 = 5s.\ 3d. \\ \therefore\ &\text{Rent} + \text{rates} &&= 8s.\ 6d. + 5s.\ 3d. = 13s.\ 9d. \text{ per week.} \end{aligned}$$

Exercise 10.

1. A landlord wishes to receive 10*s.* per week clear of rates from a house, which is rated at £22, and is situated in a district where the rates are 15*s.* 2*d.* in the £ per annum. What weekly rent (including rates) should he charge?

2. A tenant pays 14*s.* 9*d.* a week for his house, including rates. The house is rated at £21 and the rates are 13*s.* in the £ per year. What is the real weekly rent of the house, excluding rates?

3. A house is let for 11*s.* per week, excluding rates. It is rated at £24, and the rates are 14*s.* 1*d.* in the £. What rent per week must be charged so as to include rates?

4. A house is rated at £26, and is let for a weekly rent which includes rates. (*a*) How much should this rent be increased per week when the rates go up 1*s.* 4*d.* in the £ per year? (*b*) What increase of weekly rent will cover a rise in the rates of 7*d.* in the £ per quarter?

5. A landlord receives 18*s.* a week rent (including rates) from a house which is rated at £26, the rates being 13*s.* 4*d.* in the £. What actual sum does he receive as rent (apart from rates) per week?

6. A house has been let at £39 per year. It is rated at £32 10*s.* and the rates are 17*s.* 4*d.* in the £. What weekly rent must the landlord charge if he wishes to include rates?

18. Approximations.—All the examples we have given so far in this book have worked out exactly. When we are dealing with real examples, such as we come across in everyday life, we often meet cases in which the answer can only be given approximately. In such cases we require to give an answer to the nearest penny or the nearest shilling. The next example will make this point clear.

Example.—The rent (including rates) of a house is 13*s.* 6*d.* per week. The rateable value is £19 per year. How much will the rent be raised per week if the rates are increased by 1*s.* in the £ ?

$$\text{Increase of rates per year} = 19s. = 228d.$$

$$\therefore \quad \text{,,} \quad \text{,,} \quad \text{,,} \quad \text{week} = \frac{228d.}{52} = 4{\cdot}384d.$$

The answer does not work out exactly, and we have worked the division out to the third decimal place. It is obvious that no landlord could possibly increase the rent by 4·384*d.* per week. He will increase it by a whole number of pennies. In this case the rent should be raised 4*d.* per week, which is the answer to our sum *to the nearest penny.*

Note.—In working out examples of this kind, it is sufficient to carry the working as far as the first decimal place. If the figure in the first decimal place is 0, 1, 2, 3 or 4, it can be neglected. If it is 5, 6, 7, 8 or 9, we count it as equal to another penny. Thus each of the amounts 4·0*d.*, 4·1*d.*, 4·2*d.*, 4·3*d.*, 4·4*d.*, is equal to 4d. to the nearest penny, and each of the amounts 4·5*d.*, 4·6*d.*, 4·7*d.*, 4·8*d.*, 4·9*d.* is equal to 5*d.* to the nearest penny.

Exercise 11.

1. A landlord wishes to receive a clear 10*s.* 6*d.* per week rent for his house. If it is assessed at £22, and the rates are 11*s.* 6*d.* in the £, find the total amount he must charge per week (to nearest penny).

2. The rates in a certain district go up by 2*s.* 3*d.* in the £. Find (to nearest penny) the increase in weekly rent (including rates) on a house rated at £20.

3. How much must be set aside per week (to nearest penny) to meet the rates of a house assessed at £35, rates being 3*s.* 10*d.* in the £ per quarter ?

4. A tenant pays £1 1*s.* per week rent for a house, including rates. The house is rated at £30 per year, and the rates are 12*s.* 6*d.* in the £. Find the real weekly rent, apart from rates (to nearest penny).

5. A landlord lets a house for £26 a year (excluding rates). It is assessed at £22 and the rates are 16*s.* 3*d.* in the £. Find the weekly amount paid by the tenant for rent and rates together (to nearest penny).

6. If the rates in a district go down by 1*s.* 8*d.* in the £ per annum, how much a week (to nearest penny) must the landlord reduce the rent (including rates) of a house assessed at £16 per year ?

7. A tenant pays 21*s.* 9*d.* per week rent (including rates) for his house. If the house is assessed at £29 per year, how much rent should he pay in the event of the rates falling 10*d.* in the £ per half-year ?

8. A tenant rents a house at £30 per year. It is assessed at £25 and the rates are 14*s.* 8*d.* in the £ per annum. How much should he set aside weekly to meet these two items of expenditure ?

19. What Rent Includes.—We must now consider the house from the landlord's point of view. The rent which he receives is not always all profit for himself. As we have seen, he usually has to bear the cost of repairs. In addition to this expense, he may himself have to pay a rent for the ground upon which the house is built.

If this is the case, we say that his house is *leasehold.* The land belongs to another man, who is called the *ground landlord,* and a certain rent, the *ground rent,* has to be paid to the ground landlord every year by the owner of the house.

When a house is leasehold, this means that the ground landlord granted a lease to the man who originally built the house. This lease gave permission for the builder to put up the house, and granted possession of the land for a certain number of years (usually 99), upon the condition that a fixed ground rent should be paid every year.

At the end of the 99 years, when the lease expires, the land returns to the ground landlord, who then becomes also the owner of the property which has been erected upon it.

Sometimes, however, a house is *freehold.* In this case the landlord has bought the ground upon which the house stands, and both house and land belong to him. He has no ground rent to pay.

Example.—Find the actual yearly income which a landlord receives from a house rented at £50 per year (exclusive of rates) if he pays £7 10*s.* a year ground rent and spends one-sixth of the rent upon repairs.

		£	*s.*	*d.*
Ground rent	=	7	10	0
Repairs = $\frac{1}{6}$ of £50	=	8	6	8
Total expenditure	=	15	16	8
Rent	=	50	0	0
Expenditure	=	15	16	8
∴ Net income	=	34	3	4

Exercise 12.

1. Find the net annual income of a landlord who owns 4 houses, the total rent of which (exclusive of rates) is £230 per annum. He pays £27 10*s.* a year ground rent and spends one-sixth of the rent upon repairs.

2. What is the weekly income from his property (to nearest penny) of a man who owns 2 houses, let at £25 per year each (exclusive of rates), if he has to pay £8 a year ground rent and he spends one-sixth of the rent upon repairs?

3. A tenant pays 25 shillings a week for a house (including rates). The house is assessed at £27 and the rates are 15*s.* in the £ per year. Find the landlord's net yearly income from the house, if he spends £5 a year on repairs and pays £4 a year ground rent.

4. Find the net annual income of a landlord from a house which he lets at £2 10*s.* per calendar month (exclusive of rates), during a year in which he spends £4 5*s.* on repairs. The house is freehold.

5. A landlord lets a factory for £450 per year, exclusive of rates. The tenant does his own repairs. Find the landlord's net annual income, if he has to pay £42 per year ground rent.

6. A landlord lets a block of offices for £900 per year, inclusive of rates. They are assessed at £500 and the rates are 13*s.* in the £. Find his net annual income, if repairs cost him one-fifth of the gross rent which he receives, and he has to pay £55 per year ground rent.

Exercise 13.

Miscellaneous Examples on Chapters II. and III.

1. A man has to pay Insurance premiums of £3 7*s.* 11*d.* per year for himself, and 12*s.* 3*d.* per quarter for his wife. Find, to the nearest penny, the amount that should be saved weekly to meet the premiums when they become due.

2. A house is rated at £25, and the tenant has to pay rates quarterly at 4*s.* 8*d.* in the £. How much must be put by weekly to meet them (to nearest penny)?

3. A man who had been paying 10*d.* a day return on 6 days a week for his railway fare takes out a season ticket which costs him £2 6*s.* 8*d.* per quarter. How much will he save in a year, assuming that, on account of holidays, he only travels for 49 weeks during the 12 months?

4. What should the assessment be of a house rented at £54 per annum?

5. Calculate the annual assessment of a house which is let at a rental (exclusive of rates) of £1 7*s.* per week.

6. Find the total amount paid yearly for rent and rates by a man who lives in a house rented at £48 per year (exclusive of rates) in a district where the rates are 18*s.* 3*d.* in the £.

7. Coventry has a rateable value of £522,000. How much would be raised in that city by a rate of 15*s.* in the £?

8. Find the sum which would be produced by a rate of 1*s.* in the £ in the city of Exeter, which has a rateable value of £354,000.

9. A landlord estimates the rental value of a certain house (apart from rates) to be 12*s*. per week. If it is rated at £26 and the rates are 13*s*. 6*d*. in the £, what weekly rent must be charged so as to include rates ?

10. A landlord receives 8*s*. 4*d*. per week rent, including rates, for a cottage assessed at £13. If the rates are 12*s*. 8*d*. in the £ per annum, what rent does he receive weekly, not including rates ?

11. A man takes over a house at £60 per year rent. The rates are 16*s*. in the £. How much per year must he raise by subletting a part of his house, if he only wishes to pay £1 a week himself for rates and rent ?

12. What is the net annual income which a landlord receives from a house the rent of which, exclusive of rates, is £45 per year, if he spends one-sixth of the rent on repairs and pays £7 7*s*. per year ground rent ?

CHAPTER IV

EMERGENCIES AND THE NEED FOR SAVING

20. Why Saving is Necessary.—No family budget is satisfactory unless it provides for the regular saving of some part of the family income. Unless this is done, the wage-earner will find it difficult to tide over certain misfortunes which may come to him through no fault of his own. The chief of these are accident, sickness, unemployment, and death at an age when his family is still dependent upon him. In all these cases, either the man's power to work comes to an end temporarily or permanently, and his income ceases; or else his death deprives his family of their means of support.

It must be noticed, however, that the wage-earner is protected by the State against most of these calamities far more thoroughly at the present time than was ever the case before. This protection is quite independent of any steps the individual may take on his own behalf.

21. Accidents.—The chief classes of accident are as follows :

(*a*) *Accidents of Occupation—i.e.*, those which occur to a man in the course of his work. For instance, a man may be injured by machinery or in an explosion, or he may fall from a ladder or scaffolding.

(*b*) *Accidents in the Home.*—Such accidents are rare, but they do happen occasionally, and an arm or a leg may be broken, or a hand burned, which may prevent a man from working for a week or two.

(c) *Street and Travel Accidents.*—People are sometimes injured or killed as a result of an accident to a train, tram, or other conveyance, or through being run over or knocked down in the street, and in other similar ways.

The chances of any particular person being injured, as a result of an accident of either of the last two kinds, are very slight. The risk can very easily be covered nowadays by means of a *newspaper insurance.*

22. Workmen's Compensation Acts.—These Acts of Parliament protect a worker against accidents of occupation. An employer is practically compelled to insure his workpeople against such accidents, while, at the same time, the Factory Inspectors of the Home Office insist upon every possible precaution being taken to prevent accidents from happening. If an accident does occur, the employer or his Insurance Company has to pay a weekly allowance to the worker, if the latter is disabled. If he is killed, compensation is paid to his dependants.

The disablement allowance under the 1923 Act of Parliament is one-half of the average weekly wage for the previous twelve months.* The maximum allowance, however, is 30*s.* per week.

Example.—A woman temporarily disabled in an accident earned £1 12*s.* 6*d.* per week on an average for the previous 12 months. What will her disablement allowance be ?

		£	s.	d.
Average weekly wage	=	1	12	6
∴ Disablement allowance (one-half)	=	0	16	3 per week.

Exercise 14.

1. Find the disablement allowances per week of men whose average weekly earnings for the previous 12 months were (*a*) £1 10*s.*; (*b*) £1 11*s.* 4*d.*; (*c*) £1 16*s.* 8*d.*

2. Find the disablement allowances per week in the case of workers whose average weekly wages for the previous 12 months were (*a*) £1 9*s.* 8*d.*; (*b*) £1 13*s.* 10*d.*; (*c*) £1 17*s.* 10*d.*

3. A man earns £2 2*s.* per week for 25 weeks and £1 17*s.* per week for the rest of the year. Find his disablement allowance (to nearest penny).

4. What were the average weekly earnings of men whose disablement allowances were (*a*) £1 8*s.* 7*d.*; (*b*) £1 2*s.* 2*d.*; (*c*) £1 3*s.* 3*d.*; (*d*) £1 10*s.*?

* If a man is out of work for part of the year, his average wage is taken for the weeks during which he worked.

5. What were the average weekly earnings in the case of workers whose disablement allowances were (*a*) £1 6*s*. 5*d*.; (*b*) £1 4*s*. 2*d*.; (*c*) 17*s*. 4*d*.?

6. Find the disablement allowance (to nearest penny) of a man who earned £1 17*s*. 6*d*. per week for 30 weeks of a year, and £1 15*s*. 6*d*. per week for a further 12 weeks, being out of work the rest of the year.

23. Sickness.—Every worker is liable to sickness, and usually his wages cease to be paid as soon as he is absent from work. The National Health Insurance Acts provide that, if the worker has been paying contributions to National Health Insurance, a *sickness allowance** will be paid during the period of illness, provided this does not exceed 26 weeks. This allowance is 15*s*. a week in the case of a man and 12*s*. a week in the case of a woman.

If the illness lasts more than 26 weeks, the allowance is reduced to 7*s*. 6*d*. a week for men and women alike. This reduced allowance is called the *disablement benefit*.

Example.—A man has an illness that lasts for 36 weeks. What is the total amount he will receive in benefit?

		£	s.	d.
26 weeks at 15*s*.	=	19	10	0
10 " " 7*s*. 6*d*.	=	3	15	0
Total	=	23	5	0

Exercise 15.

Assume in the following examples that the contribution for Health Insurance alone (apart from the Pensions Insurance) is 5d. per week for men and 4d. per week for women, and that employers pay a further 5d. a week in each case.

1. Find the total contribution to National Health Insurance paid in a year by (*a*) a male worker; (*b*) a female worker.

2. What is the total amount paid to National Health Insurance per year by worker and employer in the case of (*a*) a man; (*b*) a woman?

3. Suppose that National Health Insurance is paid by a man for 5 years. Find (to the nearest week) the number of weeks' sickness benefit he and his employer have paid for during that time.

4. A woman pays National Health Insurance for 4 years. Find how many weeks' sickness allowance she could draw at the end of that period out of the contributions paid by herself and her employer.

5. A man is ill for 4 weeks in a year. Find the amount received

* In most cases the sickness allowance is paid through a Friendly Society, of which the worker registered himself as a member as soon as he began to pay insurance contributions.

by him in sickness allowance in excess of the contributions which he himself pays during the 48 weeks that he works.

6. A woman pays National Health Insurance for 2 years 11 weeks and is then ill for 12 weeks. How much more does she receive in sickness benefit than has been paid in contributions by herself and her employer?

7. A firm employs 25 women and 32 men, all of whom pay National Health Insurance. Find (*a*) the total contribution paid by the workers each week; (*b*) the total amount paid to National Health Insurance by the employer during 12 months.

8. A firm has working an average of 10 women and 26 men. Find the total contributions paid to National Health Insurance in a single year by the firm and its employees.

9. A firm has working an average of 135 men. How many weeks' sickness benefit could be paid out of the total contributions paid to National Health Insurance during a year?

10. A firm which has working an average of 13 women and 127 men has the following cases of sickness during a particular year: One man is ill for 30 weeks; 5 men for 3 weeks; 17 men for 2 weeks; 3 women for 5 weeks; 5 women for 3 weeks. Find (*a*) the total contribution to National Health Insurance paid by the firm and its workers during the year; (*b*) the total amount of sickness benefit paid to workers during the year; (*c*) the amount paid in contributions over and above the sickness benefit received.

24. Unemployment.—The benefit paid to workers during unemployment is 17*s*. per week in the case of men and 15*s*. per week in the case of women; for young men aged 20, 14*s*.; aged 19, 12*s*.; aged 18, 10*s*.; for young women aged 20, 12*s*.; aged 19, 10*s*.; aged 18, 8*s*.; for boys aged 16 and 17, 6*s*. per week; and for girls aged 16 and 17, 5*s*.

Exercise 16.

For unemployment contributions, see Table II. on p. 8.

1. What is the total amount that can be received in unemployment allowances in 6 months by (*a*) a man; (*b*) a woman; (*c*) a boy aged 17; (*d*) a girl aged 16?

2. What amount is received during the following cases of unemployment: (*a*) A man who is out of work 7 weeks; (*b*) a woman who is out of work 11 weeks; (*c*) a boy, aged 16, who is out of work 18 weeks; (*d*) a young woman, aged 18, who is out of work 3 weeks?

3. How much per week will be received in unemployment pay by a family in which the father and one boy of 17 are unemployed?

4. In a particular family the mother usually works as well as the father and two boys aged 16 and 18. In a single year the father

* In addition to these benefits, grants are made in respect of the dependants of unemployed persons. The amount so allowed under the 1927 Act is 7*s*. per week for the dependent wife or husband of the unemployed worker, and 2*s*. per week for each dependent child. No account has been taken of these additional benefits in our examples.

is out of work 3 weeks, the mother 5 weeks, the younger boy 2 weeks, and the older boy 30 weeks. Find the total amount received by the family as out-of-work pay.

5. A firm employs 204 men. How many unemployed men do the total contributions of the firm and its employees support ?

25. Old Age Pensions.—The State also makes provision for old age. Under the Old Age Pensions Acts, 1908 to 1924, pensions are paid to both men and women, provided that their income does not exceed a certain amount. The pensions become payable as soon as the man or woman reaches the age of 70 (50 in the case of blind persons).

The following tables show the sums paid as Old Age Pensions to various classes of people. It will be seen that the amount of the pension depends upon the income which the pensioner has apart from the pension. In estimating this income, any sums up to £39 a year received by the pensioner from any source other than earnings will not be counted. For a married couple the unearned income thus ignored will be £78 a year. *

TABLE IIIa.

Old Age Pension granted to a Claimant who is One of a Married Couple Living Together in the Same House.

Combined Yearly Means of Husband and Wife (after Deduction of Unearned Income up to £78).	*Weekly Pension.*
Not more than £52 10*s*.	10*s*.
Over £52 10*s*., but not more than £63 ..	8*s*.
„ £63 „ „ £73 10*s*...	6*s*.
„ £73 10*s*. „ „ £84 ..	4*s*.
„ £84 „ „ £94 10*s*...	2*s*.
„ £94 10*s*. „ „ £99 15*s*...	1*s*.
„ £99 15*s*.	Nil

* Contributory pensions under the Widows', Orphans' and Old Age Contributory Pensions Act, 1925, are dealt with in the supplementary notes, p. 7. The Old Age Pensions Acts, 1908 to 1924, mentioned above, are still in operation for those who do not come within the National Insurance schemes.

TABLE IIIB.

OLD AGE PENSION IN CASES NOT DEALT WITH BY TABLE IIIA.

Yearly Means of Applicant (after Deduction of Unearned Income up to £39).	*Weekly Pension.*
Not more than £26 5*s*.	10*s*.
Over £26 5*s*., but not more than £31 10*s*. ..	8*s*.
,, £31 10*s*. ,, ,, £36 15*s*. ..	6*s*.
,, £36 15*s*. ,, ,, £42 ..	4*s*.
,, £42 ,, ,, £47 5*s*. ..	2*s*.
,, £47 5*s*. ,, ,, £49 17*s*. 6*d*.	1*s*.
,, £49 17*s*. 6*d*.	Nil

In the case of Table IIIA., ***both husband and wife can claim a pension*** if they are over 70. If their combined yearly income were less than £52 10*s*. after deducting unearned income up to £78, they could each claim a pension of 10*s*. per week.

Example I.—A man aged 70, living with his wife who is 68, has an earned income of £1 2*s*. per week. His wife has no income of her own. What Old Age Pension can he claim ?

Yearly means=£1 2*s*.$\times$52=£52+£5 4*s*.=£57 4*s*.

Table IIIA. shows pension to be 8*s*. *per week*.

Example II.—A man and his wife, both over 70, have 25*s*. per week combined unearned income, apart from Old Age Pensions, while the man earns £1 per week in addition. Find their total weekly income, including their pensions.

Yearly unearned income=52$\times$25*s*.=£65.

As this is less than £78 it will not be counted.

Yearly earned income=52$\times$£1=£52.

∴ Using Table IIIA., the pension of each will be 10*s*. per week.
Total weekly income=25*s*.+£1+10*s*.+10*s*.=£3 5*s*.

EXERCISE 17.

What Old Age Pensions can be claimed in the following cases ?

1. A widower aged 70, who has a weekly income of 7*s*. 6*d*. from a house which he owns.

2. A man aged 70 living with his wife aged 69, each of whom has a weekly income from an annuity of 17*s*. 6*d*. (unearned income).

3. A widow who receives 30*s*. per week interest on her investments.

4. A woman aged 70 living with her husband aged 67, their combined earned income being £75 per year.

Find the total weekly income, including pensions, in the following cases:

5. A widow with an earned income of £26 per year.

6. A husband and wife, both over 70, with an earned income of 24*s*. per week.

7. A widower with an unearned income of 18*s*. 6*d*. per week.

8. A man aged 70 living with his wife aged 84, with a combined earned income of £1 6*s*. per week.

CHAPTER V

THE POST OFFICE SAVINGS BANK AND SAVINGS CERTIFICATES

26. Methods of Saving.—Saving is wise for many reasons. For example, it is a preparation for many of the emergencies mentioned in the last chapter, since the State Insurance allowances for sickness and unemployment are inadequate to meet the expenses of a household.

The ordinary worker is paid his wages in cash every week. If he wishes to save any money, the simplest method is for him to keep it in some safe place in the house. This is inconvenient, however, and there is always the risk of its being stolen.

The most important point is that money saved in this way does not earn any interest. It does not add to itself. And money saved is *capital*, which can always earn interest.

The most satisfactory methods of saving small sums of money at present are by putting them in the *Post Office Savings Bank* or by buying *Savings Certificates*. In each of these cases, not only is the money safe, but interest is paid, and so the money grows, quite apart from any further savings.

27. Post Office Savings Bank.—An account can be opened in the Post Office Savings Bank by any person over the age of 7. All that is necessary is to fill up a form which can be obtained in any Post Office and to make a first deposit of one or more shillings. Fractions of a shilling are not accepted as part of a deposit.

Every person who opens an account is given a *Deposit Book*, in which a record is kept of his deposits and withdrawals. Two

kinds of deposit books are in use. If the first deposit is 10*s.* or more, a book is provided in which the deposits are entered in writing. If, however, the opening deposit is less than 10*s.*, a *Coupon Book* is provided. This has spaces for twenty shilling coupons which can be bought, one or more at a time, from any Post Office. When twenty coupons have been stuck in the coupon book, this is exchanged for a book of the first kind, in which all transactions are entered in writing.

When the account has been opened, further deposits may be made at any Post Office, but the Bank Book must be taken for the deposit to be recorded.

Similarly withdrawals may be made at any Post Office. If the amount it is wished to withdraw is not more than £1, the withdrawal can be made "*on demand,*" without giving any notice. All that is necessary is to take the Deposit Book to a Post Office. This need not be the Post Office where the account was opened.

If more than £1 is to be withdrawn, notice must be given. A form must be obtained at a Post Office and filled up and sent to the Head Office, stating how much is to be drawn out, and the particular Post Office where it is desired to obtain the money.

28. The Saving of Pence.—It has been mentioned that it is only possible to bank an exact number of shillings in the Post Office Savings Bank. Those who wish to save pence can do so in two ways:

(*a*) *Home Safes* can be obtained at all Post Offices. These are steel money-boxes, which are issued to persons having accounts in the Post Office Savings Banks at a charge of 3*s.* Two shillings are returned whenever the safe is given up. The money-box is given out locked, and can only be unlocked at a Post Office. Most of the big joint-stock banks now have a similar scheme.

(*b*) Forms can also be obtained at all Post Offices with spaces for ordinary stamps. When these have been filled, they are accepted at the Post Office as if they were the actual money with which the stamps were purchased.

29. Interest.—Interest is paid at the rate of 2½ per cent. per annum on every complete pound deposited. Money put in the Bank does not, however, begin to earn interest until the beginning of the month following that in which it is banked. Thus money banked on any day in March, from the 1st to the 31st, begins to count for interest on April 1. Similarly, money drawn out of the Bank receives no interest for any part of the month in which it is withdrawn. Thus money taken out in April, upon any day from the 1st to the 30th, ceases to earn interest upon March 31.

The calculation of interest is quite a simple matter, because $2\frac{1}{2}$ per cent. $=6d.$ in the £, and $6d.$ in the £ per annum $=\frac{1}{2}d.$ in the £ per month. The method of reckoning is shown in the following example.

Example.—A man has £20 10*s.* in the Post Office Bank at the beginning of a year. He banks £5 8*s.* on March 3 and £10 10*s.* on June 7, and withdraws £8 on August 10. How much money will he have in the Bank at the end of the year, and how much interest will be payable to him ?

	Banked.			*With-drawn.*			*Balance in Bank.*		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Balance on January 1 ..	—			—			20	10	0
,, March 3 ..	5	8	0	—			25	18	0
,, June 7 ..	10	10	0	—			36	8	0
,, August 10 ..	—			8	0	0	28	8	0

∴ Balance in bank at end of year (apart from interest) = £28 8*s.*

The interest will be as follows :

		s.	*d.*
On £20 for 3 months (Jan. to Mar.)	$=20\times3\times\frac{1}{2}d.=$	2	6
,, £25 ,, 3 ,, (Apr. to June)	$=25\times3\times\frac{1}{2}d.=$	3	$1\frac{1}{2}$
,, £36 ,, 1 month (July)	$=36\times1\times\frac{1}{2}d.=$	1	6
,, £28 ,, 5 months (Aug. to Dec.)	$=28\times5\times\frac{1}{2}d.=$	5	10
	Total interest =	12	$11\frac{1}{2}$

Odd halfpennies in the final total are not counted, so the interest entered in the Bank book will be 12*s.* 11*d.*

Bank books are sent up to the Head Office in London, at the anniversary of opening the account, in an envelope provided by any Post Office. The book is then checked and an entry is made of the interest due to the end of the previous year. This interest is added to the deposits and becomes part of the *principal.* It will itself earn interest for the following year, provided that it makes up a complete pound. In the case we have just considered, the interest brings the balance up to £29 0*s.* 11*d.*, so that the interest for January of the following year would be reckoned on £29, unless any withdrawals were made.

Exercise 18.

Find (*a*) the interest earned during the year; and (*b*) the final balance at the end of the year, including interest, in the following cases:

1. A man opens an account on March 10 with £5. He banks £3 on June 12 and £6 on September 2.

2. A man has £50 in the Post Office Bank at the beginning of the year, and banks £10 on April 5 and £2 on July 3.

3. A man has £12 in the Bank on January 1 and banks £1 in February, £1 in June, £1 in August, and £1 in December.

4. A boy has £3 12*s.* in the Bank on January 1. He banks 8*s.* in February, 12*s.* in April, 10*s.* in July, and 15*s.* in November.

5. A boy opens an account in January, and banks 10*s.* at the end of every month for a year, the first deposit being 10*s.*, on January 31.

6. A boy opens an account in January and banks 8*s.* a month during the year.

7. A boy has £5 10*s.* in the Bank on January 1, and banks 6*s.* a month during the year.

8. A man has £112 in the Bank on January 1. He banks £5 in February, £5 in May, and £5 in June. He withdraws £10 in August, and banks £5 in December.

9. A man has £160 in the Bank at the beginning of the year. He withdraws £5 on April 5, £6 on April 21, and £5 on May 2, and makes no deposits during the year.

10. A man has £124 12*s.* 8*d.* in the Bank on January 1. He banks £4 in February, £3 in March, and withdraws £45 in June.

11. A man has £23 12*s.* 3*d.* in the Bank at the beginning of the year. He banks £3 every two months, beginning in February.

12. A man has £42 13*s.* 7*d.* in the Bank on January 1. He banks £1 per month during the year, except July and August.

30. National Savings Certificates.—The interest paid by the Post Office Savings Bank is at the rate of $2\frac{1}{2}$ per cent. per annum. Although this rate of interest is low, there is the advantage that the money can be withdrawn at any time in case of need.

A much higher rate of interest can be obtained by purchasing *National Savings Certificates*, but we shall see that the full rate of interest is only drawn by those people who keep their Savings Certificates for the full period. They are, therefore, a very suitable means of saving for people who do not wish to draw out their money for five or ten years.

The first National Savings Certificates were sold during the War and were known as *War Savings Certificates*. The purchase of a War Savings Certificate meant that the money paid for it was lent to the Government to help to pay for the cost of fighting. Money is still needed by the Government for various purposes, and the money invested in National Savings Certificates is lent to the Government.

In return for the loan of the money, the Government guarantees to pay interest upon it. This interest is added to the value of the certificates. The first certificates cost 15*s.* 6*d.* each, and were worth 15*s.* 9*d.* at the end of the first year, 16*s.* 9*d.* at the end of the second year, 17*s.* 9*d.* at the end of the third year, 18*s.* 9*d.* at the end of the fourth year, and £1 at the end of the fifth year. It was intended that the money should be borrowed for five years, and that each purchaser of certificates would receive £1 at the end of five years for every certificate he had bought. For this reason the certificates were called £1 Savings Certificates, although the original cost of each was only 15*s.* 6*d.* The full period was extended later on to ten years, at the end of which time each certificate will be worth £1 6*s.*

On April 1, 1922, the price of the certificates was raised to 16*s.*, while on October 1, 1923, the price was still kept at 16*s.*, but the final value of the certificates at the end of ten years was reduced to 24*s.* Table IV. shows the value of one of these certificates up to the end of the tenth year after its purchase.

It will be seen from the table that:

(*a*) No interest is paid during the first 11 months. This is to discourage holders of certificates from drawing their money out a month or two after the date of purchase.

(*b*) The normal interest is 3*d.* for every four months.

(*c*) In addition to this interest, a bonus of 1*s.* is added at the end of the tenth year.

The certificates are sold at most Post Offices and by certain Official Agents. These certificates are of four values. £1 certificates cost 16*s.*, £5 certificates cost £4, £10 certificates cost £8, and £25 certificates cost £20. No single person is allowed to hold more than £500 worth of certificates.

The repayment of the money invested in the certificates, together with the interest which has accumulated, would take place normally at the end of the tenth year after their purchase.

If repayment is desired at an earlier date, it is only necessary to make a written application on a form obtainable at a Post Office.

For those who wish to save small amounts, National Savings stamps of the value of 6*d.*, and cards to which these stamps may be affixed, can be obtained at most Post Offices.

Example I.—Find the rate of simple interest which a purchaser of National Savings Certificates receives who leaves his money in for 4 years.

TABLE IV.

VALUE OF NATIONAL SAVINGS CERTIFICATES.

(THIRD ISSUE).

Purchase Price : 16*s.* *Value after Six Years :* £1 0*s.* 0*d.* *Value after Ten Years :* £1 4*s.* 0*d.*

On Completion of	1*st* *Year.*	2*nd* *Year.*	3*rd* *Year.*	4*th* *Year.*	5*th* *Year.*	6*th* *Year.*	7*th* *Year.*	8*th* *Year.*	9*th* *Year.*	10*th* *Year.*
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
4th month	0 16 0	0 16 6	0 17 3	0 18 0	0 18 9	0 19 6	1 0 3	1 1 0	1 1 9	1 2 6
8th month	0 16 0	0 16 9	0 17 6	0 18 3	0 19 0	0 19 9	1 0 6	1 1 3	1 2 0	1 2 9
12th month	0 16 3	0 17 0	0 17 9	0 18 6	0 19 3	1 0 0	1 0 9	1 1 6	1 2 3	1 4 0

The above table gives the value of the Third Issue of Savings Certificates—viz., those sold on and after October 1, 1923. The First Issue of 15*s.* 6*d.* Certificates (worth £1 6*s.* at the end of 10 years) were on sale prior to April 1, 1922. The Second Issue of 16*s.* Certificates (worth £1 6*s.* at the end of 10 years) were on sale from April 1, 1922, to September 30, 1923.

Value of 1 certificate after 4 years $= 18s.\ 6d.$

$\therefore$ Interest on 16s. for 4 years $= 2s.\ 6d.$

$\therefore$ „ „ 100s. for 1 year $= \dfrac{2\frac{1}{2} \times 100}{16 \times 4} = 3{\cdot}9$ per cent. (to first decimal place).

Example II.—I buy 12 certificates. Find their value after 2 years 8 months.

Value of 1 certificate (see Table IV.) $= 17s.\ 6d.$

$\therefore$ Value of 12 certificates $= 17s.\ 6d. \times 12$
$= £10\ 10s.\ 0d.$

Exercise 19.

1. What rate of simple interest do I receive by investing my money in National Savings Certificates for a period of (*a*) 2 years; (*b*) 3 years; (*c*) 5 years; (*d*) 7 years; (*e*) 10 years ? (Answers correct to first decimal place.)

2. Find the value of (*a*) 14 certificates after 3 years 4 months; (*b*) 25 certificates after 5 years 4 months; (*c*) 50 certificates after 8 years 8 months; (*d*) 36 certificates after 1 year 8 months; (*e*) 100 certificates after 8 years 4 months.

3. How much interest shall I receive (*a*) on 25 certificates which are kept for 6 years 4 months; (*b*) on 30 certificates which are kept for 2 years 8 months; (*c*) on 12 certificates which are kept for 8 years; (*d*) on 100 certificates which are kept for 9 years 8 months; (*e*) on 20 certificates which are kept for 10 years ?

4. How much must I invest in Savings Certificates to be worth £36 in 10 years' time ?

5. How much would a man receive in repayment of 21 certificates which he had kept for 4 years 4 months, and 10 certificates which he had kept for 2 years 8 months?

6. How many Savings Certificates can I buy for (*a*) £8 16*s*.; (*b*) £15 4*s*.; (*c*) £50 8*s*. ?

Exercise 20.

Miscellaneous Examples on Chapters IV. and V.

1. What disablement allowance could be claimed by a man temporarily disabled by an accident at work, if his total earnings during the previous year amounted to £97 1*s*. 4*d*. ?

2. A man's disablement allowance, under the Workmen's Compensation Act, is £1 2*s*. 1*d*. per week. What were his average weekly earnings during the year before the accident ?

3. A man's average earnings during the year previous to an accident were £1 16*s*. 8*d*. How much will he receive altogether in disablement allowance, if he is away from work for 11 weeks ?

4. A woman is ill for 10 weeks in a year. How much more will she receive in sickness allowance (under the National Health Insurance)

than the total contributions paid by herself and her employer during the 42 weeks that she worked ? (See Exercise 15.)

5. A man pays National Health Insurance for 3 years and is then ill for 7 weeks. To how many more weeks' benefit would the total contributions paid by himself and his employer be equivalent (to nearest week) ?

6. In a certain family, the husband, wife, and one son, aged 17, are all working. Find their total annual contribution to National Health, Pensions, and Unemployment Insurances.

7. In a certain family, during 1 year, the husband receives the unemployment allowance for 6 weeks and the sickness allowance for 3 weeks, and his son, aged 17, receives the unemployment allowance for 11 weeks. Find the total amount received by the family in these allowances during the year.

8. A man pays National Health Insurance for 3 years 10 weeks and is then ill for 16 weeks. How much more will he receive in sickness benefit than has been paid in contributions by himself and his employer ? (See Exercise 15.)

9. A firm employs an average of 120 men and 50 women. Find the amount of the total contributions to National Health, Pensions, and Unemployment Insurances in a year by the firm and its employees.

10. A firm employs 408 men, all of whom pay Unemployment Insurance contributions. How many men's unemployment allowances could be paid out of the combined contributions of the firm and its employees ?

11. What Old Age Pension could be claimed by a widow, aged 70, with an earned income of 12*s.* per week ?

12. What Old Age Pension would be paid to a man aged 70, living with his wife, aged 64, if their joint earned income were £1 6*s.* 0*d.* per week ?

13. What would be the total weekly income, including Old Age Pensions, of a husband and wife both over 70, with an independent joint unearned income of £3 5*s.* per week ?

14. What would be the total weekly income, including the Old Age Pension, of a man aged 70, living with his wife, aged 69, if their combined earned income, independent of the pension, were £1 5*s.* 6*d.* per week ?

15. A man opens an account in the Post Office Savings Bank on February 17 with £4. He banks £5 on April 4 and £7 on August 3. How much will he have in the Bank, including interest, by the end of the year?

16. A man has £74 12*s.* 3*d.* in the Post Office Savings Bank at the beginning of the year. He banks £2 on March 5, £3 on June 15, and £5 on September 2. How much will he have in the Bank to start the next year with ?

17. What interest will be earned on a man's deposits in the Post Office Savings Bank, if he has £120 in the Bank on January 1, and banks £10 on March 2, £8 on June 12, and withdraws £5 on September 15 ?

18. Find the value of 25 Savings Certificates after a period of 7 years 4 months.

19. How much interest shall I receive on 12 Savings Certificates which are kept for 4 years 10 months ?

20. How much would a man receive in repayment of 35 certificates which he has kept for 5 years 2 months ?

CHAPTER VI

FIRE AND "ALL-IN" INSURANCES

31. What Insurance is.—In Chapter IV. we mentioned some of the emergencies for which the worker has to prepare. In every branch of life there are emergencies of one kind or another. Thus a house or factory may be burned down, a shop may be burgled, a ship may sink, and a motor-car may be damaged in an accident. In each of these cases the immediate expenditure of a large sum of money may be required, which no budget of estimated expenditure could cover.

Very few people could afford to run the risk of having to face emergencies of this kind without some assistance. Fortunately, a way has been invented of enabling everyone to prepare for such happenings. This is by means of *Insurance*, which we have already mentioned in considering the scheme whereby the State compels every worker to contribute weekly to a common fund, out of which he will be paid certain benefits in case of unemployment or sickness.

The principle of insurance is simply this. Instead of every individual facing his own risks out of his own means, a large number of people, who are liable to the same risk, agree to stand together and share it. This sharing of risk is arranged by the various Insurance Companies.

32. Fire Insurance.—This is probably the simplest type of insurance to understand. If a man owns the house in which he lives, he may know that if it should be burned down, it would be impossible for him to have it rebuilt. Most people are in this position. They are all, however, quite able and willing to pay a small sum every year into a common fund, on condition that, out of it, money shall be provided to pay for the rebuilding of any property belonging to one of them which should happen to be damaged by fire.

The Insurance Company brings these people together and enables them to join forces to share their risk.

33. Premiums.—First of all, the Insurance Company must find out what sum of money each person must pay per year in order to

provide a total amount sufficient to cover the whole risk. This sum of money is called the *premium.* To find out what premium to charge, the Insurance Company must discover what the *average risk* is. In order to do this, it is necessary to obtain figures showing the average damage done by fire to the kind of house which is to be insured.

We will take a very simple example. Suppose that the figures of the Insurance Company show that, in the case of 10,000 small houses worth £400 each, the total damage by fire per year (taking the average for a number of years) is £2,000. This sum would be met if every householder paid the sum of £$\frac{2000}{10000}$ or 4*s.* per annum.

In actual practice there are one or two points of difference:

(*a*) The figures of the Insurance Company deal with a much greater number of houses. In fact, they arrange the whole property of the country into certain classes, and thus find the average risk for each class.

(*b*) The actual premium charged would usually be greater than the average figure we have mentioned. This is because there are the expenses of the Insurance Company to be paid, and also the Company must be prepared to meet a sudden risk which may exceed the average risk over a number of years. Suppose the Company decided to charge an extra 50 per cent. to cover these possibilities. This would make the premium 6*s.* per annum in the case we have taken.

(*c*) All houses are not of the same value, so it would not be fair to charge every householder the same premium. In order to share the risk in a fair way, it is, therefore, customary to state the premium as being so much per cent. of the value of the property which is insured.

Thus, in the case we took, the premium for a house of £400 value was 6*s.* (allowing the extra 50 per cent. charged by the Insurance Company). This is equal to 1*s.* 6*d.* per £100, and the premium would be stated as being 1s. 6*d.* per cent.

Example.—The figures of an Insurance Company show that, for a certain class of business, premises of a total value of £15,000,000 have fires doing an average annual damage of £22,500. What premium per cent. will just cover this risk?

Damage to property worth £15,000,000 = £22,500

$\therefore$ „ „ „ £100 $= \frac{£22,500 \times 100}{£15,000,000}$

$= £\frac{3}{20} = 3s.$ per cent.

Exercise 21.

What premium per cent. must an Insurance Company charge for Fire Insurance in the case of classes of property the fire risks of which are shown by the following table? Assume that it is desired just to cover the risk:

	Value of Property.	*Average Annual Damage by Fire.*
	£	£
1.	125,000,000	62,500
2.	52,800,000	30,800
3.	30,300,000	20,200
4.	55,400,000	41,550

What premium per cent. must an Insurance Company charge for Fire Insurance in the case of classes of property the fire risk of which is shown in the following table, if an extra 50 per cent. is added to the risk to cover unforeseen circumstances?

	Value of Property.	*Average Annual Damage by Fire.*
	£	£
5.	72,000,000	42,000
6.	54,600,000	18,200
7.	47,400,000	19,750
8.	37,200,000	24,800

9. The premium of an Insurance Company for insuring house property against fire is 1*s.* 3*d.* per cent. If this premium just covered the damage done by fire during a certain year, find the total amount the Insurance Company had to pay, if the value of the property insured was (*a*) £5,600,000; (*b*) £785,000; (*c*) £1,255,000.

10. If the insurance premium against fire is 1*s.* 4*d.* per cent., how many houses of the same value would an Insurance Company have to insure in order to be able to afford to pay for the complete rebuilding of one house per year?

The following example will illustrate how the Insurance Companies recognize the way in which the risk of fire, and the danger of any outbreak of fire being serious, depend upon all sorts of conditions. When large insurances are in question, it is usual to make certain allowances, in the form of reduced premiums, for the provision of special facilities for avoiding an outbreak, or for dealing with it speedily should one occur.

Example.—A man insures his business premises against fire for £12,000. The premium is 10*s.* 6*d.* per cent., but he is allowed a rebate of 12½ per cent. because he has fire hydrants installed in the building, and a further rebate of 10 per cent. of the

remainder on account of having an Automatic Fire Alarm. What will be the actual premium ?

Premium on £100	=	10s. 6d.		
$\therefore$,, £12,000	=	120 × 10s. 6d.		
	=	£63	0	0
Deduct $12\frac{1}{2}$ per cent. $=\frac{1}{8}$	=	7	17	6
		55	2	6
Deduct 10 per cent. $=\frac{1}{10}$	=	5	10	3
Net premium	=	£49	12	3

34. Domestic or "All-in" Policies.—When a house is rented, it is the business of the landlord to insure the premises against fire. The tenant, however, must himself insure his furniture and other belongings, unless he is prepared to face the risk of losing them by fire. A small premium (usually 2s. 6d. per cent.) would be sufficient to insure them against the risk of fire.

As a matter of fact, the Insurance Companies which take this class of business will generally cover the householder for many other risks besides fire. *Domestic or "All-in" Policies* will provide insurance against fire, burglary, petty theft, damage through burst water-pipes or explosion, and a number of other things, including injury to a servant or charwoman, for which payment may have to be made under the Workmen's Compensation Act.* The premium is usually about 5s. per cent.

Example.—A man insures his house against fire for £1,000 at a premium of 1s. 6d. per cent. and insures his furniture and other personal belongings for £500 at a premium of 5s. per cent. How much should he include in his weekly budget for these items ?

Annual premium for house = 10 × 1s. 6d. = 15s.

,, ,, domestic policy = 5 × 5s. = £1 5s.

$\therefore$ Total premium = £2.

Weekly amount $= \frac{480d.}{52} = 9d.$ (to nearest penny).

Exercise 22.

1. A man owns six houses, each of the value of £800. What annual premium must he pay to insure them against fire with an Insurance Company whose rate is 1s. 9d. per cent.?

2. A family values its furniture and other belongings at £450. They take out an "All-in" policy at 5s. per cent. What is the weekly amount which they should include in the family budget to cover the premium (to nearest penny) ?

* See p. 23.

3. Find the total annual premium to be paid by a man who insures his house, valued at £750, against fire at 1*s.* 6*d.* per cent., and his furniture, worth £400, against fire only at 2*s.* 6*d.* per cent.

4. A firm pays for Fire Insurance on its business premises, valued at £14,000, at the rate of 8*s.* 6*d.* per cent. Find the annual premium.

5. A man insures his factory, which is valued at £7,500, against fire at the rate of 5*s.* 6*d.* per cent. He is allowed a reduction of 10 per cent. because he provides special fire appliances. What annual premium does he pay ?

6. A man who has been paying a Fire Insurance premium of 6*s.* 3*d.* per cent. on his business premises valued at £10,500 succeeds in taking out an insurance with another Company at 4*s.* 6*d.* per cent. What will he save in his annual premium ?

7. A man pays an annual premium of £36 15*s.* 0*d.* to insure his factory premises, valued at £14,000, against fire. At what rate per cent. is he charged ?

8. A man pays an annual Fire Insurance premium of £29 5*s.* 0*d.* upon his business premises. If the rate for insurance is 3*s.* 3*d.* per cent., what is the value of the premises insured ?

CHAPTER VII

WHOLE LIFE INSURANCE

35. Whole Life Insurance.—Life Insurance is the means by which a man can protect his dependants against the loss of income and support which they would suffer in the event of his early death. The simplest form of Life Insurance is called *Whole Life Insurance.* Under this form of insurance, an Insurance Company agrees to pay a fixed sum of money to a man's dependants when he dies. This sum which the Insurance Company pays is exactly the same whether the man lives for fifty years or dies the week after taking out the insurance. The man himself agrees to pay a fixed premium every year of his life.

A clear idea of the relation between the sum for which the man insures his life and the premiums which he has to pay is given by the following table. This gives the average premiums charged by Insurance Companies for various ages of entry, when the amount insured for is £100.

Obviously, the older a man is when he takes out an insurance policy, the less number of years he will be living to pay his premiums, and therefore the greater the sum he will be called upon to pay each year.

TABLE V.

Annual Premiums for Whole Life Insurance for £100.

Age at Entry.	*Annual Premium.*	*Age at Entry.*	*Annual Premium.*	*Age at Entry.*	*Annual Premium.*
	£ *s.* *d.*		£ *s.* *d.*		£ *s.* *d.*
21	1 11 2	31	2 0 2	41	2 15 4
22	1 11 10	32	2 1 4	42	2 17 3
23	1 12 7	33	2 2 7	43	2 19 4
24	1 13 5	34	2 3 11	44	3 1 7
25	1 14 3	35	2 5 5	45	3 4 0
26	1 15 2	36	2 6 11	46	3 6 7
27	1 16 1	37	2 8 6	47	3 12 1
28	1 17 1	38	2 10 1	48	3 17 10
29	1 18 1	39	2 11 9	49	4 16 6
30	1 19 1	40	2 13 6	50	6 1 10

Premiums for amounts over £100 are calculated proportionately. Thus a man aged 31 who wishes to insure himself for £400 would be required to pay annual premiums of 4×£2 0*s.* 2*d.* or £8 0*s.* 8*d.*

Exercise 23.

Use Table V. in order to find the premiums in this set of examples.

1. Find the annual premiums for Whole Life Insurance in the following cases:

(*a*) A man aged 34 insuring for £500.
(*b*) ,, ,, 37 ,, ,, £350.
(*c*) ,, ,, 50 ,, ,, £700.
(*d*) ,, ,, 43 ,, ,, £400.

2. Find (to the nearest penny) the amounts that must be set apart weekly to meet the annual premiums in the following cases:

(*a*) A man aged 23 insuring for £100.
(*b*) ,, ,, 26 ,, ,, £250.
(*c*) ,, ,, 45 ,, ,, £400.
(*d*) ,, ,, 36 ,, ,, £300.

3. A man aged 46 takes up a Whole Life Insurance policy for £600. How much more does he pay as an annual premium than he would be doing if he had taken up his insurance at the age of 21 ?

4. Two men, aged 25 and 38, decide to take up Whole Life Insurance policies for £200 each. Find the difference between their annual premiums.

5. A man aged 49 takes up an insurance policy for £300. What sum could he have insured himself for if he had been able and willing to start paying the same annual premiums at the age of 26 ? (Answer to nearest pound.)

6. A father takes out Whole Life Insurance policies for himself, aged 47, and his two sons aged 21 and 23. They are for £100 each. Find the weekly amount that must be put by to meet the annual premiums.

7. Suppose it is possible to pay the premiums quarterly by paying an additional 5 per cent. Find the quarterly premiums in the following cases:

(a) A man aged 30 insuring for £100.
(b) ,, ,, 26 ,, ,, £200.
(c) ,, ,, 31 ,, ,, £350.

(Give answers to nearest penny.)

8. Suppose it is possible to pay the premiums monthly by paying an additional 10 per cent. Find the monthly premiums in the following cases:—

(a) A man aged 32 insuring for £150.
(b) ,, ,, 25 ,, ,, £250.
(c) ,, ,, 39 ,, ,, £450.

(Give answers to nearest penny.)

36. Expectation of Life.—A Life Insurance premium is a much more difficult figure to calculate than the premium for Fire Insurance. It is still, however, a question of average risk.

Every birth and every death in the United Kingdom is registered, and the information is sent to the office of the Registrar-General. From the figures thus obtained, tables have been drawn up, showing the average number of years which people who have already reached different ages may still be expected to live. The following is a simplified table (p. 43), which gives this information correct to the nearest year.

There is one point which is at first rather puzzling about the expectation of life, as shown in this table. It is that, whereas a man aged 20 can expect to live another 41 years to the age of 61, a man aged 60 expects to live another 13 years, and not one year as we might at first expect. This difficulty is due to the fact that we are considering average figures in the table. The average age to which people live who reach the age of 20 is 61.

When we consider the further expectation of life of people aged 60, all the people who die before reaching the age of 60 are left out of our calculations, so that the average age which those who are left will attain is greater than 61, being in fact 73.

Table VI. tells the Insurance Companies the *average number of premiums* that will be paid by persons who take out insurance policies at various ages.

TABLE VI.

EXPECTATION OF LIFE.*

Age.	*Average Number of Years of Further Life.*	
	Men.	*Women.*
20	41	43
25	37	39
30	33	35
35	29	31
40	26	28
45	22	24
50	19	21
55	16	17
60	13	14
65	10	11
70	8	9

Since the premiums are paid in advance, a man who insures his life will pay one more premium than the number of complete years that he lives after taking out the policy. He pays one premium as soon as he takes out the insurance, and the day after the end of the first year the second annual premium is due, and so on.

Thus men who insure at the age of 25 will live (on an average) 37 more complete years, and will pay an average of 38 annual premiums.

37. Calculation of Premiums.—We will first consider what premiums the Insurance Company would have to charge if they simply hoarded the money up, instead of investing it and earning interest by means of it, as they actually do.

A man aged 25 can expect to live 37 more years and would pay

* In actual practice, the Insurance Companies expect the people they insure to live rather longer, on the average, than this table shows. This is because everyone who wishes to insure his life has to undergo a medical examination. Only those who are physically fit are accepted for insurance.

38 annual premiums. The amount of each premium would, therefore, be £$\frac{100}{38}$ or £2 12*s.* 8*d.* to the nearest penny.

But Table V. shows that the actual premium charged is £1 14*s.* 3*d.*, or 18*s.* 5*d.* less than the amount we have calculated. So that in 37 years the man would pay £1 14*s.* 3*d.* × 38 = £65 1*s.* 6*d.*, and at the end of the 37 years the Insurance Company would expect to pay the full amount of £100. The Insurance Company, therefore, promise to pay £34 18*s.* 6*d.* more than they expect to receive in premiums. They can do this because they invest all premiums as soon as they are received, and it is the interest which the premiums earn which enables them to reduce the premiums to the figures shown in Table V.

Even when the premiums are reduced to this extent, the Insurance Company can pay all the expenses of collecting and looking after the premiums and still make a profit on their Life Insurance business. Insurance Companies are business concerns and make profits, if they are properly conducted, in the same way as other businesses.

Exercise 24.

Using Table V., find the total amount paid in premiums in the following cases:

1. A man who insures for £200 at the age of 24 and lives 30 years.
2. A man who insures for £700 at the age of 29 and lives 16 years.
3. A man who insures for £100 at the age of 31 and lives 21 years.

Note.—The number of premiums will be one more than the number of years of further life.

Using Table V., find how much more the Insurance Company pay out than they receive in premiums in the following cases:

4. A man who insures for £500 at the age of 33 and lives just over 18 years.
5. A man who insured his life for £400 on December 1, 1910, at the age of 35, and died on January 2, 1921.
6. A man who insured his life for £150 on June 25, 1907, at the age of 26, and died on June 24, 1920.

Using Tables V. and VI., find how much the Insurance Company expect to receive in premiums in the following cases:

7. A man of 30 who insures his life for £500.
8. ,, ,, 35 ,, ,, ,, £200.
9. ,, ,, 40 ,, ,, ,, £350.
10. ,, ,, 45 ,, ,, ,, £700.

EXERCISE 25.

Miscellaneous Examples on Chapters VI. and VII.

1. What premium per cent. must an Insurance Company charge for Fire Insurance for factory premises in a business for which statistics show that the average annual damage done by fire has amounted to £14,875 on property of a total value of £10,500,000 ? (Assume that the Insurance Company adds 50 per cent. to the average risk.)

2. The figures of an Insurance Company show that, in the case of business premises of a certain kind, premises of a total value of £15,400,000 have fires doing an average annual damage of £23,100. What premium per cent. will just cover this risk ?

3. If the premium for Fire Insurance on house property is 2*s.* per cent., how many houses of the same value must be insured to cover the cost of repairing the damage done by fire to a similar house, the bill for which is one-eighth of the value of the house ?

4. A certain Insurance Company insures £12,420,000 worth of house property against fire. In a single year it paid out £7,245 for damage done by fire to this property. What premium per cent. would just have covered this damage ?

5. An Insurance Company insures £6,850,000 of property at an average premium of 1*s.* 9*d.* per cent. What is its income from this source ?

6. A man insures his house worth £900 against fire for 1*s.* 6*d.* per cent., and his furniture and other belongings, valued at £550, for 2*s.* 6*d.* per cent. What total annual premium does he pay ?

7. A man insures his business premises, valued at £11,500, against fire at the rate of 4*s.* 8*d.* per cent. He is allowed a reduction of $12\frac{1}{2}$ per cent. for special fire appliances. What does his annual premium amount to ?

8. A man pays an annual Fire Insurance premium of £42 upon his business premises. If the rate is 5*s.* 3*d.* per cent., what is the value of the premises insured ?

9. A man pays a premium for Fire Insurance of £7 7*s.* per year upon his factory, which he values at £4,200. At what rate per cent. is this reckoned ?

10. Using Table V., find what annual premium a man would expect to pay if he wished to insure his life for £1,200 at the age of 35.

11. Using Table V., find what quarterly premium (to the nearest penny) a man aged 37 will have to pay to insure his life for £300. (Assume that an additional 5 per cent. has to be paid for quarterly premiums.)

12. A man takes out a Whole Life Insurance for himself for £200 at the age of 32. What weekly amount should be put by to meet the annual premium ? (Answer to nearest penny.)

13. A man aged 42 takes out a Whole Life Insurance policy for £500. How much more does he pay as an annual premium than he would be doing if he had taken up his insurance at the age of 25 ?

14. Using Table V., find the total amount paid in premiums by a man who insured his life for £250 at the age of 32 and lived for 18 years.

15. Find the total amount paid in premiums by a man who insured his life for £300 at the age of 22 and lived for 45 years.

16. How much more will an Insurance Company pay out than it receives in premiums in the case of a man who insures his life for £600 at the age of 30 and lives a further 20 years ?

17. Using Tables V. and VI., find how much an Insurance Company expects to receive in premiums from a man who insures his life for £700 at the age of 30.

18. How much does an Insurance Company calculate on receiving in premiums from a man who insures his life for £450 at the age of 40 ?

CHAPTER VIII

DECIMALIZATION OF MONEY

[BEFORE we can go any further in attempting to understand how Life Insurance premiums are calculated, we must know how to decimalize money, as well as how to use approximate methods of working. These subjects will be dealt with in the next two chapters.]

38. Expression of a Sum of Money as a Decimal of £1.—We start from the fact that:

$2s. = \frac{1}{10}$ of £1 = £·1, so that $4s.$ = £·2, $6s.$ = £·3, and so on.
$1s. = \frac{1}{2}$ of $2s.$ = £·05, so that $7s. = 6s. + 1s.$ = £·35.
$6d. = \frac{1}{2}$ of $1s.$ = £·025, so that $4s.\ 6d.$ = £·225.

There is thus no difficulty in dealing with sums of money consisting only of shillings and a sixpence.

All amounts less than sixpence are converted into farthings, and $\frac{1}{4}d. = \frac{1}{24}$ of $6d. = \frac{1}{24}$ of £·025 = £·001$\frac{1}{24}$. Thus:

$1\frac{1}{4}d. = 5f.$ = £·005$\frac{5}{24}$,
and $4\frac{3}{4}d. = 19f.$ = £·019$\frac{19}{24}$.

It is usually enough to give the decimal correct to 3 places. In the case of $1\frac{1}{4}d.$, $\frac{5}{24}$ is less than $\frac{1}{2}$, so that the approximate decimal is £·005. In the case of $4\frac{3}{4}d.$, $\frac{19}{24}$ is greater than $\frac{1}{2}$, so the approximate decimal is ·020.

The rules for decimalizing fractions of £1 less than $6d.$ are, therefore, as follows:

(*a*) If the amount is less than $3d.$, multiply ·001 by the number of farthings.

(*b*) If the amount is $3d.$ or over, multiply ·001 by one more than the number of farthings.

Thus $2\frac{1}{2}d. = 10f.$ = £·010; $5\frac{1}{2}d. = 22f.$ = £·023.

In order to express any sum of money as the decimal of £1, correct to 3 places, we proceed as follows: First, we express the shillings and sixpence (if there happens to be one) as decimals of £1, and then we add on the decimal value of any odd amount less than 6*d*. Thus:

$$19s.\ 3\tfrac{1}{2}d. = £(\cdot 95 + \cdot 014) = £\cdot 964$$
$$15s.\ 8\tfrac{3}{4}d. = £(\cdot 75 + \cdot 025 + \cdot 009) = £\cdot 784$$

After a little practice the middle step can be omitted, and the complete decimal written down at once.

Exercise 26.

Express the following sums of money as decimals of £1 (correct to 3 places):

1. 4*s*. 6*d*.	2. 9*s*. 6*d*.	3. 11*s*. 6*d*.	4. 8*s*. $1\frac{1}{4}d$.
5. 15*s*. $2\frac{1}{2}d$.	6. 7*s*. $1\frac{1}{4}d$.	7. 16*s*. 2*d*.	8. 5*s*. 4*d*.
9. 6*s*. 3*d*.	10. 9*s*. $7\frac{1}{2}d$.	11. 19*s*. $3\frac{1}{2}d$.	12. 17*s*. $1\frac{1}{2}d$.
13. 3*s*. 11*d*.	14. 1*s*. $11\frac{1}{2}d$.	15. 14*s*. $9\frac{1}{4}d$.	16. 16*s*. $10\frac{1}{2}d$.

39. Conversion of a Decimal of £1 into Shillings and Pence.—This is quite simple if we bear in mind what was done in the opposite process, dealt with in paragraph 38. First, we notice the figures in the first 2 decimal places and convert them into shillings. If there is a decimal fraction ·025 left over, we know that this is equal to 6*d*., while any further decimal is converted into farthings, and from them into pence.

This final remainder must be £·024 or less. If it lies between £·001 and £·012, we can read off the number of farthings directly, since ·001 = 1 farthing, and £·012 = 12 farthings, while if it is over ·012, we subtract £·001 mentally before converting to farthings. Thus:

$£\cdot 017 = 16f.$, and $£\cdot 024 = 23f.$
$£\cdot 602 = 12s. + 2f. = 12s.\ 0\frac{1}{2}d.$
$£\cdot 753 = 15s. + 3f. = 15s.\ 0\frac{3}{4}d.$
$£\cdot 429 = £\cdot 425 + £\cdot 004 = 8s.\ 6d. + 4f. = 8s.\ 7d.$
$£\cdot 797 = £\cdot 75 + £\cdot 025 + £\cdot 022 = 15s.\ 6d. + 21f. = 15s.\ 11\frac{1}{4}d.$
$£4\cdot 382 = £4\cdot 35 + £\cdot 025 + £\cdot 007 = £4\ 7s.\ 6d. + 7f. = £4\ 7s.\ 7\frac{3}{4}d.$

Exercise 27.

Express the following decimals of £1 as £ *s*. *d*.:

1. £·357	2. £·429	3. £·053	4. £2·661
5. £3·325	6. £4·475	7. £2·989	8. £6·082
9. £5·888	10. £3·247	11. £·731	12. £4·111
13. £3·224	14. £7·564	15. £9·783	16. £2·849

40. Decimalization of Money to more than 3 Places.—For some purposes, 3 places of decimals are not enough, and we need to give the decimal value of a sum of money to 4 or more places.

There is no difficulty in dealing with shillings and a sixpence, because the decimals which represent them are exact. All we have to learn is how to decimalize odd sums of money less than 6*d.*

We will first take the case of a whole number of pence. $5d. = \cdot 020\frac{20}{24}$, as we already know, and this is absolutely correct, and not an approximation. We have an approximate result only when we say that $5d. = \cdot 021$, correct to 3 places.

$\cdot 020\frac{20}{24} = \cdot 020\frac{5}{6}$, and if we require to carry the decimal beyond 3 places, we need only divide the 5 by the 6. Thus $\cdot 020\frac{5}{6}$ to 6 places $= \cdot 020833$.

If the sum includes farthings or a halfpenny we employ a similar method. Thus $3\frac{1}{4}d. = \cdot 013\frac{13}{24}$, and we can write this as $\cdot 013\frac{3\cdot 25}{6}$, by dividing both numerator and denominator of the fraction by 4. The division is now easy, and we can carry the decimal places as far as we please by dividing 3·25 by 6.

$$3\tfrac{1}{4}d. = \cdot 0135416\ \ldots, \text{ or } \cdot 01354, \text{ correct to 5 places.}$$

The rule is therefore as follows: To obtain the figures after the third decimal place, express the pence and farthings as a decimal of a penny and divide by 6.

Example.—Express £5 11*s.* 9½*d.* as a decimal of £1 correct to 5 places.

$$\begin{aligned} £5\ 11s.\ 9\tfrac{1}{2}d. &= £(5\cdot 575 + \cdot 014\tfrac{3\cdot 5}{6}) \\ &= £5\cdot 589\tfrac{3\cdot 5}{6} \\ &= £5\cdot 58958\dot{3} \\ &= £5\cdot 58958, \text{ correct to 5 places.} \end{aligned}$$

Note.—The shillings and any odd sixpence are first written down as an exact decimal. This only leaves any fraction of £1 *less than sixpence to be worked out beyond the third decimal place.*

Exercise 28.

Express in decimals of £1 correct to 5 places, the following:

1. £2 5*s.* 4*d.*	2. £5 6*s.* 7*d.*	3. £3 10*s.* 1*d.*
4. £1 17*s.* 1½*d.*	5. £7 12*s.* 4½*d.*	6. £6 1*s.* 2½*d.*
7. £7 15*s.* 5¼*d.*	8. £1 11*s.* 1¼*d.*	9. £2 13*s.* 2¼*d.*
10. £6 7*s.* 3½*d.*	11. £8 3*s.* 6½*d.*	12. £9 11*s.* 7¾*d.*

41. Conversion of a Decimal of £1 into Shillings and Pence, to the Nearest Penny.—If we have to convert into £ *s. d.* an approximate decimal, and the answer is required correct to the nearest penny, we must proceed as in the following example.

Example.—Express £7·439079 in £ *s.* *d.* to the nearest penny.

£7·439079 = £7·43908 to 5 decimal places.
= £(7 + ·4 + ·025 + ·01408
= £7 8*s.* 6*d.* + £·01408
= £7 8*s.* 6*d.* + (·01408 × 240)*d.*
= £7 8*s.* 6*d.* + 3·3792*d.*
= £7 8*s.* 6*d.* + 3*d.* to nearest penny.
= £7 8*s.* 9*d.* to nearest penny.

The rules for proceeding are therefore as follows:

(i.) Obtain the decimal correct to 5 places.

(ii.) Convert the portion of this decimal which represents pounds, shillings, and a possible sixpence into £ *s.* *d.*

(iii.) Multiply the remainder (which must be less than 6*d.*) by 240 to bring it to pence. It is then quite easy to state the answer correct to the nearest penny.

Exercise 29.

Express in £ *s.* *d.*, correct to the nearest penny, the following:

1. £3·456783.	**2.** £1·37321.	**3.** £4·267153.
4. £7·42357.	**5.** £8·16182.	**6.** £5·637489.
7. £8·21782.	**8.** £3·411229.	**9.** £6·312351.
10. £11·422867.	**11.** £2·71489.	**12.** £7·141536.

CHAPTER IX

APPROXIMATE METHODS

42. Approximations.—We have already mentioned several times the need that often arises for giving an approximate answer to a problem. For instance, we have asked for answers that do not work out exactly to be given to the nearest penny; and in the last chapter we discussed how to express a sum of money as a decimal of £1 correct to a certain number of places.

When we say that a sum of money equals £2·597 correct to the third decimal place, we know that the decimal is only approximate. We mean by our statement that the true value of the sum of money is nearer to £2·597 than it is to either £2·596 or £2·598.

The decimal 2·597 is the approximate value to 3 places of any one of the decimals 2·5965, 2·5966, 2·5967, 2·5968, 2·5969, 2·5970, 2·5971, 2·5972, 2·5973, and 2·5974.

To give a decimal true to 3 places, we must know the value of the figure in the fourth place of decimals. If this is 0, 1, 2, 3, or 4.

we ignore it, but if it is 5, 6, 7, 8 or 9, we add 1 to the figure in the third place. Thus 2·1572 = 2·157 to 3 places; but 2·1576 = 2·158 to 3 places.

43. Addition.—If we have to find the sum of two or more numbers, correct to a certain number of decimal places, we must first know the value of each of the original numbers correct to *two more places* than we are required to give in our answer. For instance, if our answer is to be correct to 3 decimal places, each number must be known correct to 5 places. This is because we must know the figure in the fourth place, in order to give the nearest figure in the third place; and the figure in the fourth place will be affected by any figure that is "carried" from adding up the figures in the fifth place.

Example.—Add £2·315723, £1·438359, £7·412345 and £6·3472834, and give the answer correct to 3 decimal places.

(*a*)	(*b*)
£2·31572	£2·315 | 72
1·43836	1·438 | 36
7·41235	7·412 | 35
6·34728	6·347 | 28
£17·51371	£17·514 |
= £17·514 to 3 places.	

This example is worked out in two ways, of which (*b*) is the one usually employed. In both cases we have first written down the separate numbers correct to 5 places.

In case (*a*) the addition in full is given. The figures in the fifth decimal place add up to 21, and 2 is carried to the fourth decimal place, which then adds up to 17.

In case (*b*) the addition is carried out mentally until the third decimal place is reached. As the fourth decimal place adds up to 17, we carry 2 to the third decimal place, because 17 is nearer to 20 than it is to 10.

44. Subtraction.—The method used in the process of subtraction is similar to that used in addition.

Example.—Find, correct to the third decimal place, the difference between £7·145929 and £4·734321.

(*a*)	(*b*)
£7·14593	£7·145 | 93
4·73432	4·734 | 32
£2·41161	£2·412 |
= £2·412 to 3 places.	

In case (*a*) we show the full working. In case (*b*) the working is mental until the third decimal place is reached. As the figure in the fourth place is "6," we add "1" to the figure obtained in the third decimal place.

Exercise 30.

Find the value, correct to 3 decimal places, of the following:

1. £2·194273 + £3·701213 + £4·4134121.
2. £6·231243 + £1·382617 + £2·657901 + £4·58000.
3. £1·742891 + £2·634132 + £3·471129 + £1·362356.
4. £2·1347829 + £4·1678923 + £5·223145 + £5·121314.
5. £8·7384951 − £2·617732.
6. £9·914632 − £3·435412.
7. £6·637456 − £3·343547.
8. £7·317562 − £4·426345.

45. Multiplication.—In order that we may see how the need arises for contracted methods of multiplication, we will return to the subject which we discussed at the end of Chapter VII. In that chapter, Table VI., on page 43, gave *in a simplified form* what we called the "expectation of life" at various ages. The expectation of life at each age was, in fact, given correct *to the nearest year*. The form of table in general use, however, gives the expectation of life correct to the second decimal place.

Table VII., which we give on p. 53, shows in the second column the expectation of life (in the case of men) correct to the second decimal place; and in the third column it gives the annual premiums for Whole Life Insurance for £100 converted into decimals of £1 correct to 5 places. These premiums are the same as those given in Table V. on page 41.

Using Table VII., we can calculate almost exactly the average total amount paid in premiums by men who insure at various ages. In working out examples we shall assume that the expectation of life figures are correct, and not merely correct to 2 places of decimals.

Example I.—Find, to the nearest shilling, the average total amount paid in premiums by men who insure at the age of 33.

Number of premiums paid is one more than the number of years of further life = 30·75 + 1 = 31·75.*

∴ Total amount paid in premiums = £2·12917 × 31·75.

* Of course, no one can ever be called upon to pay a fraction of a premium. The fraction arises in this case because it is the *average* number of premiums paid which we have to consider.

We will first work the multiplication out in full.

$$\begin{array}{lr|l}
 & \pounds & \\
 & 2\cdot1291 & 7 \\
 & 31\cdot7 & 5 \\
\hline
(a) & 63\cdot8751 & \\
(b) & 2\cdot1291 & 7 \\
(c) & 1\cdot4904 & 19 \\
(d) & \cdot1064 & 585 \\
\hline
 & \pounds67\cdot6011 & 475
\end{array}$$

The answer is required correct to the nearest shilling. We need to know it, therefore, correct to the *second* decimal place. We must carry our working, as in the case of addition, to 2 more decimal places than are needed in the answer. Each partial product (*a*), (*b*), (*c*), and (*d*) need be worked out only to *four* decimal places. The figures on the right of the vertical line are unnecessary.

The most convenient method of working out the multiplication so as to avoid unnecessary figures is as follows:

$$\begin{array}{lr|l}
 & \pounds & \\
 & 2\cdot1291 & 7 \\
 & 31\cdot & 75 \\
\hline
(e) & 63\cdot8751 & \\
(f) & 2\cdot1292 & \\
(g) & 1\cdot4904 & \\
(h) & \cdot1065 & \\
\hline
 & \pounds67\cdot6012 & \\
\end{array}$$

$= \pounds67\cdot60$ correct to 2 decimal places

$= \pounds67\ 12s.$

In order to make quite clear what figures are necessary, the vertical line has been drawn, as suggested in the previous working out in full.

The multiplicand (2·12917) is first written down, and a vertical line drawn after the fourth decimal place. The multiplier (31·75) is then set down with its units figure (1) immediately to the left of the vertical line. The rules for obtaining the partial products (*e*), (*f*), (*g*), and (*h*) are then as follows:

(i.) To obtain the partial product due to multiplying by a figure in the units place, we begin the multiplication upon the figure in the multiplicand which is immediately above it.

(ii.) To obtain the partial product due to multiplying by a figure one or more places to the *left* of the units figure, we begin the multiplication upon the figure in the multiplicand which is *the same number of places to the right* of the vertical line.

(iii.) To obtain the partial product due to multiplying by a figure one or more places to the *right* of the units figure, we begin the multiplication upon the figure in the multiplicand which is *one more than that number of places to the left* of the vertical line.

TABLE VII.

EXPECTATION OF LIFE AND ANNUAL INSURANCE PREMIUMS.

Age.	*Expectation of Life.*	*Annual Premiums for £100.*
	Years.	£
31	32·29	2·00833
32	31·51	2·06667
33	30·75	2·12917
34	29·99	2·19583
35	29·24	2·27083
36	28·50	2·34583
37	27·77	2·42500
38	27·05	2·50417
39	26·34	2·58750
40	25·64	2·67500

Thus in multiplying by 1 in the units place, we begin by multiplying the 1 immediately above it.

In multiplying by 3 in the tens place, we begin on the 7 in the multiplicand.

In multiplying by the 5, which is *two* places to the right of the vertical line, we begin the actual multiplication on the 2 in the multiplicand, which is *three* places to the left of the vertical line.

Note.—In each case, however, before we actually start writing our results down, we must know the correct figure to be " carried "

and added on to our first figure. We start off, therefore, by *multiplying mentally* the figure to the right of the one mentioned in the rules above. Thus, when multiplying by the 7 to obtain the line (*g*), we first multiply mentally $7 \times 1 = 7$. This is nearer 10 than 0, so we carry 1. We then start our proper multiplication with $7 \times 9 = 63$, and adding the 1 we have carried we get 64, and accordingly we write down the 4, as shown in the example, and carry the 6. After that, the multiplication proceeds in the ordinary way.

Example II.—Find, to the nearest pound, the average total of the premiums paid by men who insure for Whole Life Insurance for £200 at the age of 38.

	From Table VII., expectation of life	$= 27{\cdot}05$ years.
∴	Number of premiums paid	$= 28{\cdot}05$.
	Premium for £100 insurance	$= £2{\cdot}50417$.
∴	" " £200 "	$= £5{\cdot}00834$.
	Total amount paid in premiums	$= £5{\cdot}00834 \times 28{\cdot}05$.

The answer is required to the nearest pound, so we must obtain it correct to the units figure. Therefore we must work to 2 places of decimals.

$$\begin{array}{r|l}
\text{£} & \\
5{\cdot}00 & 834 \\
28{\cdot} & 05 \\
\hline
100{\cdot}17 & \\
40{\cdot}06 & \\
{\cdot}25 & \\
\hline
\text{£}140{\cdot}48 & \\
\end{array}$$

= £140 (to nearest pound).

Exercise 31.

Obtain the necessary figures from Table VII., and find (to the nearest pound) the average total of the premiums paid for Whole Life Insurance in the following cases:

1.	**Men who insure for**	**£100**	**at the age of**	**31.**
2.	**"**	**"**	**£200**	**"**	**"**	**32.**
3.	**"**	**"**	**£300**	**"**	**"**	**33.**
4.	**"**	**"**	**£100**	**"**	**"**	**34.**
5.	**"**	**"**	**£200**	**"**	**"**	**35.**

Find the average total, to the nearest shilling, of the premiums paid in the following cases:

6.	Men who insure for	£200	at the age of	36.
7.	,, ,,	£500	,, ,,	37.
8.	,, ,,	£300	,, ,,	38.
9.	,, ,,	£400	,, ,,	39.
10.	,, ,,	£100	,, ,,	40.

46. Division.—The working out of a division sum can also be contracted, when the answer is to be an approximation. In order that we may appreciate the way in which working out is simplified and shortened by using the contracted method, we will consider a practical example of a kind of problem of which we considered a simplified example in Chapter III.

Example I.—The rateable value of a certain London borough is £2,426,282. The district expenses for a certain half-year are estimated at £830,565. Find, to the nearest penny, the rate in the £ which must be levied for the half-year.

$$\text{Rate to be levied on } £2{,}426{,}282 = £830{,}565$$
$$\therefore \quad ,, \quad ,, \quad ,, \quad ,, \quad £1 \quad = £\frac{830{,}565}{2{,}426{,}282}$$

We will first work out this division in the ordinary way. In order to obtain the answer correct to the nearest penny, we must know the answer correct to the fifth decimal place. We must, therefore, work it out to 6 decimal places. The full working out is as follows:

$$\begin{array}{r|l}
2{,}426{,}282\ )\ 830565{\cdot}0 & (\ £{\cdot}342320 \\
7278846 & \\
\hline
1026804 & 0 \\
970512 & 8 \\
\hline
56291 & 20 \\
48525 & 64 \\
\hline
7765 & 560 \\
7278 & 846 \\
\hline
486 & 7140 \\
485 & 2564 \\
\hline
1 & 45760
\end{array}$$

Rate $= £{\cdot}342320$ in the £.

$= £{\cdot}34232$, correct to fifth decimal place.

$= £({\cdot}3 + {\cdot}025 + {\cdot}01732)$

$= 6s.\ 6d. + ({\cdot}01732 \times 240)d.$

$= 6s.\ 6d. + 4{\cdot}1568d.$

$= 6s.\ 6d. + 4d.$ (to nearest penny).

$= 6s.\ 10d.$ in the £.

The working in the above example can be shortened by omitting all figures to the right of the vertical line. The contracted working out then appears as follows:

```
24,2,6,2,8,2 ) 830565·0 ( £·342320
               7278846
               -------
               1026804
                970513
               -------
                 56291
                 48526
               -------
                  7765
                  7279
               -------
                   486
                   485
               -------
                     1
```

The following are the rules for working according to this contracted method:

(i.) Decide how many decimal places the answer must be worked out to. (We decided 6 places.)

(ii.) Estimate the answer in order to find out the *place* of the first figure, whether it is in the units, tens, hundreds, etc., place, or the first, second, etc., decimal place. (Our rough estimate would be $\frac{8}{24}=\cdot3$. First figure in first decimal place.)

(iii.) When we know the information from (i.) and (ii.) we know how many *significant figures* there will be in the quotient. (In this case there will be *six* significant figures.)

(iv.) We must leave *one more digit* in the divisor than the number of significant figures required in the quotient. (In this example the divisor already consists of 7 digits, which is the number required. If there had been more than 7 digits we should have discarded all after the first 7.)

(v.) Begin dividing by the divisor so obtained. This will give us the first figure in our answer. We already know its *place* value from our rough estimate.

(vi.) Having thus obtained our first figure in the quotient, instead of bringing down the next figure of the dividend, we strike off the end digit of the divisor. (This leaves us with 242628, which is the divisor for the second figure of our answer.) We repeat this after every further division.

(vii.) There is no need to carry out the full working for the last figure in our answer. We can see what this is (in our case it is 0) and we can simply write it down.

We will now take a further example.

Example II.—The assessable value of a city borough is £3,426,105. What rate in the £ would have to be levied in order to raise £1,436,732 ? Answer required to nearest penny.

$$\text{Rate in the £} = £\frac{1,436,732}{3,426,105}$$

Answer must be found correct to 5 decimal places.
∴ It must be worked out to 6 decimal places.

Estimated answer $= £\frac{1}{3} = £{\cdot}3\ \ldots$

First significant figure is in first decimal place.
∴ There will be 6 significant figures in quotient. We must retain 7 digits in divisor. The divisor actually consists of 7 digits.

```
34,2,6,1,0,5 ) 1436732·0 ( £·419351
               13704420
               --------
                 662900
                 342610
                 ------
                 320390
                 308349
                 ------
                  12041
                  10278
                  -----
                   1763
                   1713
                   ----
                     50
```

Rates in the £ $= £{\cdot}41935$
$= £({\cdot}4 + {\cdot}01935)$
$= 8s. + ({\cdot}01935 \times 240d).$
$= 8s. + 4{\cdot}644d.$
$= 8s.\ 5d.$ to nearest penny.

Note.—(i.) When multiplying the divisor by each figure in the quotient, we first multiply the figure to the right of the dash by the figure in the quotient, in order to obtain the correct carrying figure. For instance, when multiplying by 5, the fifth figure in the quotient, we multiply 5×6 mentally and carry 3. The proper multiplication then begins. $5 \times 4 = 20$, but 3 has been carried, so the first figure to be set down is 3.

(ii.) If the divisor contains fewer figures than are required for the contracted method, the division is continued in the ordinary long multiplication way until the number of figures in the divisor is two more than the remaining figures in the quotient. When this is the case, we strike off the last figure and begin the contracted method.

Thus suppose we have to find the value of 3354·293 ÷ 2643 to the third decimal place. The procedure is as follows:

Answer required to 3 decimal places.
∴ It must be worked out to 4 decimal places.
Estimated answer $= \frac{3}{2} = 1·5$.
First figure is in units place, so there will be 5 significant figures in our answer.
∴ We require 6 digits in our divisor. As we have only 4 digits we shall proceed at first as in ordinary division.

```
26,4,3 ) 3354·293 ( 1·2691
         2643
          7112
          5286
          18269
          15858
           2411
           2379
             32
```

Answer to 2 places = 1·27

It will be noticed that the divisor was first contracted *after* obtaining the figure "6" in the quotient. We had then to obtain 2 further figures in the quotient and the divisor contained 4 digits.

EXERCISE 32.

Find, to the nearest penny, the rate in the £ which must be levied for the half-year in the case of the boroughs mentioned in the following table:

Borough.	*Rateable Value.*	*Estimated Expenses for Half-Year.*
	£	£
1. City of London..	5,881,066	1,463,422
2. Battersea	1,034,410	476,345
3. Chelsea	927,485	323,373
4. Greenwich	692.345	274,975
5. Hampstead	1,146,517	386,479
6. Wandsworth	2,261,671	803,728
7. Durham	78,171	33,276
8. Hastings	422,123	163,421
9. Nottingham	1,351,415	557,234
10. Stoke-on-Trent..	848,014	334,791

Exercise 33.

Miscellaneous Examples on Chapters VIII. and IX.

[All examples from No. 13 are to be worked out by contracted methods, expressing sums of money, where necessary, as decimals of £1.]

1. Express 18*s*. 7½*d*. as a decimal of £1 correct to 3 places.
2. „ £4 15*s*. 11½*d*. „ „ „ „ „
3. „ £3 14*s*. 5*d*. „ „ „ „ „
4. „ £12·567 in £ *s*. *d*.
5. „ £9·983 „ „
6. „ £3·211 „ „
7. „ £3 12*s*. 3½*d*. as a decimal of £1 correct to 5 places.
8. „ £4 9*s*. 2*d*. „ „ „ „ „
9. „ £11 3*s*. 11½*d*. „ „ „ „ „
10. „ £4·612132 in £ *s*. *d*. to nearest penny.
11. „ £3·278912 „ „ „ „
12. „ £11·365520 „ „ „ „
13. Find the value of £3·456243 + £2·763479 + £1·6324731 to 3 decimal places.
14. Find the value of £2·357921 + £3·763423 to the nearest penny.
15. Find the value of £8·763435 − £7·124317 to the nearest penny.
16. Obtain the necessary figures from Table VII., and find (to the nearest pound) the average total of the premiums paid for Whole Life Insurance in the case of men who insure for £350 at the age of 34.
17. What total amount does an Insurance Company expect to receive, in the average case, from a man aged 37 who takes out a Whole Life Insurance policy for himself for £700? (Answer to nearest pound.)
18. Eastbourne has a rateable value of £493,298. What rate in the £, correct to the nearest penny, would have to be levied to meet an estimated half-yearly expenditure of £182,347?

CHAPTER X

COMPOUND INTEREST

47. Accumulation of Money at Compound Interest.—It is interesting to consider how the premiums paid to the Insurance Companies accumulate by reason of the interest which they earn. This interest is *compound interest*. That is to say, the money received in interest in one year is invested again in the following year and itself earns interest, which is invested a year later, and so on.

Example I.—What will £3 7*s*. 5*d*. amount to in 3 years at 5 per cent. compound interest? (Give answer to nearest penny.)

This example will be worked in decimals, and as the answer is required to the nearest penny, we shall require to have 5 places of decimals correct in our final result. We must therefore work with 7 decimal places according to the rule in paragraph 44 of the last chapter.

		£	
£3 7*s*. 5*d*.	=	3·3708333	= Principal for first year.
5 per cent.	= $\frac{1}{20}$ ∴	·1685417	= Interest ,, ,, ,,
		3·5393750	= Principal for second year.
5 per cent.	= $\frac{1}{20}$ ∴	·1769688	= Interest ,, ,, ,,
		3·7163438	= Principal for third year.
5 per cent.	= $\frac{1}{20}$ ∴	·1858172	= Interest ,, ,, ,,
		£3·9021610	= Amount at end of third year.

∴ Amount at end of third year = £3·90216 (to 5 decimal places)
= £(3·9 + ·00216)
= £3 18*s*. + (·00216 × 240)*d*.
= £3 18*s*. + ·5184*d*.
= £3 18*s*. 1*d*. (to nearest penny).

If the rates of interest are not like 5 per cent., which can be expressed as an easy divisor, we must proceed as in the following example:

Example II.—What will £72 9*s*. 10*d*. amount to in 3 years at 7 per cent. compound interest? (Give answer to nearest penny.)

		£	
£72 9*s*. 10*d*.	=	72·49166'67	= Principal for first year.
7 per cent. = ·07	∴	5·07441'66	= Interest ,, ,, ,,
		77·56608'33	= Principal for second year.
7 per cent. = ·07	∴	5·42962'58	= Interest ,, ,, ,,
		82·99570'91	= Principal for third year.
7 per cent. = ·07	∴	5·80969'96	= Interest ,, ,, ,,
		£88·80540 87	= Amount at end of third year.

∴ Amount at end of third year = £88·80541 (to 5 decimal places)
= £(88·8 + ·00541)
= £88 16*s*. + (·00541 × 240)*d*.
= £88 16*s*. + 1·2984*d*.
= £88 16*s*. 1*d*. (to nearest penny).

In each case, in order to multiply by ·07, we commence actual multiplication upon the figure to the left of the dash. This is in accordance with rule (iii.) on page 53.

First, however, we multiply the figure to the right of the dash, mentally, in order to determine the "carrying" figure.

Exercise 34.

Find, to the nearest penny, what the following sums will amount to in 3 years at compound interest:

1. £534 13*s*. 5*d*. at 5 per cent. ($\frac{1}{20}$).
2. £7 17*s*. 3*d*. at $2\frac{1}{2}$ per cent. ($\frac{1}{40}$).
3. £18 3*s*. 10*d*. at 2 per cent. ($\frac{1}{50}$).
4. £6 14*s*. 11*d*. at 5 per cent.
5. £25 11*s*. 8*d*. at $2\frac{1}{2}$ per cent.
6. £12 10*s*. 4*d*. at 2 per cent.
7. £37 15*s*. 7*d*. at 3 per cent. (·03).
8. £29 17*s*. 4*d*. at 4 per cent. (·04).
9. £31 11*s*. 8*d*. at 7 per cent. (·07).
10. £15 13*s*. 10*d*. at 6 per cent. (·06).

Find, to the nearest penny, what the following sums would amount to in 4 years at compound interest:

11. £27 15*s*. 7*d*. at 5 per cent.
12. £35 5*s*. 5*d*. at 3 per cent.
13. £5 17*s*. 1*d*. at 4 per cent.
14. £1 14*s*. 2*d*. at 7 per cent.
15. £12 11*s*. 3*d*. at 6 per cent.
16. £13 12*s*. 11*d*. at $2\frac{1}{2}$ per cent.

48. How Premiums Accumulate at Compound Interest.—In the case of premiums paid to Insurance Companies, we have to consider how money accumulates at compound interest, when a fixed sum is added, year by year, to the original capital invested.

Example.—The premium on an Insurance policy is £1 5*s*. 6*d*. per annum. Find how much the premiums will amount to by the end of 3 years, reckoning compound interest at 5 per cent. (Give answer to the nearest penny.)

We require 5 decimal places correct in our answer.
∴ We must work to 7 decimal places.

		£
First premium paid at beginning of first year	=	1·275
Interest for first year at 5 per cent. ($=\frac{1}{20}$)	=	·06375
Total amount at end of first year	=	1·33875
Premium paid at beginning of second year	=	1·275
Total amount at beginning of second year	=	2·61375
Interest for second year at 5 per cent. ($=\frac{1}{20}$)	=	·1306875
Total amount at end of second year	=	2·7444375
Premium paid at beginning of third year	=	1·275
Total amount at beginning of third year	=	4·0194375
(*a*) Interest for third year at 5 per cent. ($=\frac{1}{20}$)	=	·2009719
Amount at end of third year		=£4·2204094

= £4·22041 (to 5 decimal places)
= £(4·2 + 0·02041)
= £4 4*s*. + (·02041 × 240)*d*.
= £4 4*s*. + 4·8984*d*.
= £4 4*s*. 5*d*. (to nearest penny).

Note.—In obtaining the interest (*a*) for the third year we did not carry the division beyond the seventh decimal place, which is as far as we need work.

EXERCISE 35.

Find, to the nearest penny, what sum annual premiums of £1 (payable at the beginning of each year) will amount to in 3 years at the following rates of compound interest:

1. 2 per cent. 2. 3 per cent. 3. 4 per cent. 4. 6 per cent. 5. 7 per cent. 6. 2½ per cent.

Find, to the nearest penny, what sum—

7. Annual premiums of £2 will amount in 4 years at 4 per cent compound interest.

8. Annual premiums of £3 will amount to in 4 years at 5 per cent. compound interest.

9. Annual premiums of £1 17*s.* 8*d.* will amount to in 3 years at 3 per cent. compound interest.

10. Annual premiums of £3 18*s.* 6*d.* will amount to in 2 years at 2½ per cent. compound interest.

49. Tables of Compound Interest.—It is obvious from the examples worked out in the last paragraph that it would be very tedious to calculate compound interest over a number of years. This is not necessary in practice, because tables have been worked out giving us results from which we can make any calculations we may need. Table VIII. shows the sum to which annual premiums of £1 will amount at the rates of 2½ and 3 per cent. compound interest. Similar tables exist for other rates of interest.

This table is quite easy to understand. For instance, taking the 2½ per cent. column, in 1 year the amount is £1·025. This figure tells us at once that £1 was invested at the beginning of the first year, and that this £1 has gained £·025 interest and become £1·025 at the end of the first year.

In 7 years the amount is £7·736. This includes 7 premiums of £1 each, the last of which was paid at the beginning of the seventh year. The interest gained is, therefore, £·736, which equals 14*s.* 9*d.* to the nearest penny.

Example I.—Using Table VIII., find what interest will have been earned at 3 per cent. at the end of 28 years upon annual premiums of £1 invested at the beginning of every year of that period.

Sum to which premiums amount in 28 years	= £44·219
Amount paid in premiums	= £28
Interest	= £16·219
	= £16 4*s.* 5*d.* (to nearest penny).

This interest is seen to be considerable, and it is on account of it that the Insurance Companies are enabled to demand such reasonable premiums for Life Insurance.

TABLE VIII.

Showing the Sum to which Annual Premiums of £1 (Payable at the Beginning of Each Year) will amount by the End of a Given Number of Years.

Years.	$2\frac{1}{2}$ *per Cent.*	3 *per Cent.*	*Years.*	$2\frac{1}{2}$ *per Cent.*	3 *per Cent.*
	£	£		£	£
1	1·025	1·030	16	19·865	20·762
2	2·076	2·091	17	21·386	22·414
3	3·153	3·184	18	22·946	24·117
4	4·256	4·309	19	24·545	25·870
5	5·388	5·468	20	26·183	27·676
6	6·547	6·662	21	27·863	29·537
7	7·736	7·892	22	29·584	31·453
8	8·955	9·159	23	31·349	33·426
9	10·203	10·464	24	33·158	35·459
10	11·483	11·808	25	35·012	37·553
11	12·796	13·192	26	36·912	39·710
12	14·140	14·618	27	38·860	41·931
13	15·519	16·086	28	40·856	44·219
14	16·932	17·599	29	42·903	46·575
15	18·380	19·157	30	45·000	49·003

Example II.—The annual premium asked by a certain Insurance Company for Whole Life Insurance for £100 is £2 16*s*. 3*d*. for a man who insures at the age of 35. The expectation of life in such a case is 29·24 years. If the Insurance Company invests the premiums at $2\frac{1}{2}$ per cent. compound interest, as soon as they are received, how much money (to the nearest pound) should they have in hand by the end of the 29·24 years if the man is still living? Assume that no interest is earned in the last ·24 of a year.

£2 16*s*. 3*d*. = £2·8125.

From Table VIII. we see that annual premiums of £1 for 29 years at $2\frac{1}{2}$ per cent. compound interest become	£42·903
Add premium paid at beginning of the 30th year	1·000
Total amount in hand for premiums of £1	£43·903

∴ Annual premiums of £2·8125 will become £43·903 × 2·8125.

(The answer is required to the nearest £1, so we need only work to the second decimal place.)

```
 43·90 3
     2· 8125
 87·81
 35·12
   ·44
   ·09
   ·02
123·48   = £123 (to the nearest pound).
```

The case we have considered in Example II. is the one which the Insurance Company considers when working out premiums. The man in this example lives the average number of years. So the Insurance Company could actually obtain a sum of £123 by investing the premiums received in the case of the average person insured at the rate of $2\frac{1}{2}$ per cent. compound interest. The amount that the Insurance Company is called upon to pay out is only £100. The extra £23 covers the expenses of running the Insurance Company, and also provides a very fair margin of profit. If compound interest can be earned at the rate of 3 per cent., the gain is, of course, greater, and a large number of Insurance Companies are able to secure this higher rate of interest on their investments.

Exercise 36.

The following examples are to be worked out, using the information given in Table VIII.

Give, to the nearest penny, the sums of money to which annual premiums of £1 will amount in—

1. 10 years at $2\frac{1}{2}$ per cent.	2. 18 years at $2\frac{1}{2}$ per cent.
3. 26 ,, $2\frac{1}{2}$,,	4. 11 ,, 3 ,,
5. 15 ,, 3 ,,	6. 30 ,, 3 ,,

Find, to the nearest shilling, the sums of money to which—

7. Annual premiums of £5 will amount in 12 years at 3 per cent. compound interest.

8. Annual premiums of £3 will amount in 25 years at $2\frac{1}{2}$ per cent. compound interest.

9. Annual premiums of £4 will amount in 26 years at 3 per cent. compound interest.

10. Annual premiums of £2 5*s.* will amount in 13 years at $2\frac{1}{2}$ per cent. compound interest.

11. Annual premiums of £5 17*s.* 6*d.* will amount in 17 years at 3 per cent. compound interest.

12. Annual premiums of £3 15*s.* will amount in 29 years at $2\frac{1}{2}$ per cent. compound interest.

If an Insurance Company invests the premiums at $2\frac{1}{2}$ per cent. compound interest as soon as they are paid, find (to the nearest pound) how much the premiums would amount to in the following cases of men who insured for £100 Whole Life Insurance, and lived to an average age (assume that no interest is earned during the last fraction of a year.):

13. A man of 50, whose expectation of life is 18·9 years, and who has to pay annual premiums of £4 11*s.* 6*d.*

14. A man of 47, whose expectation of life is 20·86 years, and who has to pay annual premiums of £4 2*s.* 6*d.*

15. A man of 48, whose expectation of life is 20·20 years, and who has to pay annual premiums of £4 8*s.*

CHAPTER XI

OTHER FORMS OF LIFE INSURANCE

50. Whole Life Insurance, with Limited Premiums.—A man who insures for Whole Life Insurance in the ordinary way promises to pay a fixed premium every year until he dies. He may feel, however, that if he lives to an old age, and is unable to work as hard or to earn as much money as he could when he was a young man, he may find it difficult to keep up the annual payments.

Fortunately, this difficulty can easily be overcome by the system of *Whole Life Insurance, with limited premiums.* In this case the annual premiums only continue for a certain number of years—say until the age of 55 or 60, or any other age the insured person may wish. The annual premiums are, of course, rather heavier than when they are continued right through life. If the insured person dies before 55 or 60, the £100 is paid in the usual way. If the person reaches the age at which the payment of premiums ceases, he is given what is called a *fully paid-up policy.* No further premiums need be paid, but the Insurance Company does not pay out the £100 until the death of the insured person.

51. Weekly and Monthly Premiums.—Many people who wish to insure their lives in this way prefer to pay their premiums weekly or monthly, instead of quarterly, half-yearly, or yearly.

Most of the chief Insurance Companies provide for this need, and have special arrangements for those who wish to pay their premiums weekly. Insurance books are provided, in which the collector gives a receipt for the premiums which are collected either weekly or every four weeks.

Insurances may be taken out by any person between the ages of 14 and 50. Premiums cease usually at the age of 60. The following is an extract from a table showing the sums payable at death to persons paying various small sums weekly.

TABLE IX.

Insurance by Weekly Premiums.

No Premiums payable after the Age of 60.

Age next Birthday.	2*d.* *per Week will Insure for*			3*d.* *per Week will Insure for*			4*d.* *per Week will Insure for*			5*d.* *per Week will Insure for*			6*d.* *per Week will Insure for*		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
15	20	5	0	32	19	0	47	5	0	61	12	0	76	0	0
20	17	4	0	27	19	0	40	2	0	52	6	0	64	9	0
25	14	14	0	23	19	0	34	8	0	44	17	0	55	6	0
30	12	6	0	20	1	0	28	16	0	37	11	0	46	6	0
35	10	1	0	16	8	0	23	10	0	30	13	0	37	17	0
40	7	18	0	12	18	0	18	10	0	24	3	0	29	16	0

Insurances not exceeding £25 can usually be effected with or without medical examination, but for insurances above that amount medical examination is required.

Exercise 37.

Write down, from Table IX., the amounts payable at death upon payment of the premiums mentioned:

1. A man aged 19 who pays 3*d.* per week.
2. " " 24 " 5*d.* "
3. " " 29 " 4*d.* "
4. " " 34 " 2*d.* "
5. " " 39 " 6*d.* "

Find the total amount paid in premiums in the following cases, assuming that the insured person lives beyond the age of 60 :

6.	A man	just under	25	who insures	for	£14 14s.
7.	,,	,,	30	,,	,,	£20 1s.
8.	,,	,,	35	,,	,,	£30 13s.
9.	,,	,,	40	,,	,,	£29 16s.

How much more will be paid out at death than will be paid in premiums in the following cases, in all of which the insured person lives beyond the age of 60 ?

10.	A man	just under	30	who pays	3*d.*	per week.
11.	,,	,,	35	,,	4*d.*	,,
12.	,,	,,	40	,,	6*d.*	,,
13.	,,	,,	25	,,	5*d.*	,,

How much more will be received from the Insurance Company in the payment at death than is paid in premiums in the following cases ?

14.	A man	just under	20	who pays	4*d.*	per week	and lives	10	years.
15.	,,	,,	25	,,	3*d.*	,,	,,	7	,,
16.	,,	,,	30	,,	6*d.*	,,	,,	14	,,
17.	,,	,,	40	,,	5*d.*	,,	,,	5	,,
18.	,,	,,	35	,,	3*d.*	,,	,,	16	,,

52. Endowment Insurance.—Under this system of insurance not only are the premiums limited to a fixed number, but the amount insured for is payable either at the end of a fixed term of years, or when the insured person reaches a certain age. If death takes place before the fixed date, the amount insured for becomes payable immediately. Thus, suppose a man takes out an Endowment Insurance Policy for £100 to mature at the age of 60; then, if the man lives for the full period, he will pay his last premium at the age of 59, and receive the £100 at the age of 60. If he dies at an earlier age than 60 the £100 will be paid at once, as in the case of ordinary insurance.

This is the most popular form of insurance, as many people feel that when they have grown older and their children have grown up, it will be less necessary for them to provide for their dependants, but, at the same time, it will be more necessary for them to make some provision for their own old age. This form of insurance, therefore, combines *ordinary life insurance* in the event of early death, with *saving for old age*, in the event of the insured person living the full term of years.

53. Bonus or Participating Policies.—The examples which we have taken up to the present have been, in all cases, of insurance for a definite sum of money; and we have seen that, as a result of investing the premiums paid, the Insurance Company invariably makes a profit on its Life Insurance business. This is in spite of

the facts that certain expenses have to be met in running Life Insurance, and also that every company sets aside a certain proportion of the premiums paid every year as a margin of safety.

In the departments both of Whole Life Insurance and Endowment Insurance, it is now possible to take out *Bonus or Participating Policies*, which entitle the insurer to share in any profits that may be made by the Insurance Company. The assets and liabilities of the company are valued every year or every five years, and a bonus is then declared on all profit-sharing policies.

Should there be no surplus money to be shared, then the participating policy-holders will really be sharing in the company's losses. The premiums for "*with profits*" insurance are slightly greater than those for "*without profits*" insurance, and, if no profits are made, then this extra premium has been paid without any advantage being received.

54. Comparative Premiums.—Table XI. shows what may be regarded as average premiums for Whole Life Insurance (with and without profits) and for Endowment Insurance, maturing at the ages of 55 and 60. Both sets of premiums for Endowment Insurance are for "with profits" policies. All the premiums are for £100 insurance.

TABLE X.

COMPARATIVE PREMIUMS FOR £100 INSURANCE.

Age.	*Whole Life Insurance.*		*Endowment Insurance Payable at Death or Age of*	
	Without Profits.	*With Profits.*	60 (*with Profits*).	55 (*with Profits*).
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
25	1 14 3	2 3 1	2 18 0	3 6 0
26	1 15 2	2 4 1	2 19 9	3 8 6
27	1 16 1	2 5 2	3 1 7	3 11 2
28	1 17 1	2 6 4	3 3 7	3 14 0
29	1 18 1	2 7 6	3 5 8	3 17 0
30	1 19 1	2 8 9	3 7 10	4 0 2
31	2 0 2	2 10 0	3 10 1	4 3 6
32	2 1 4	2 11 3	3 12 5	4 7 2
33	2 2 7	2 12 8	3 14 11	4 11 2
34	2 3 11	2 14 2	3 18 3	4 15 10
35	2 5 5	2 15 9	4 2 0	5 1 0

55. Bonuses.—The bonuses on "with profits" policies are granted every one, three, or five years. They usually amount to about 30*s.* per cent. per annum. The bonuses are added to the value of the policy. Thus, if bonuses of 30*s.* per cent. are declared every year, a £100 policy (with profits) is worth £100 during the first year, £101 10*s.* during the second year, £103 during the third year, and so on. A £500 policy would increase by £7 10*s.* every year.

When a "with profits" insurance is taken out with a successful Insurance Company, therefore, the sum insured for is not a stationary amount, but increases year by year.

Example I.—A man insures his life for Whole Life Insurance for £200 (with profits). He dies during the seventh year after taking out the policy. If bonuses have been declared of 30*s.* per cent. every year, find the amount that the Insurance Company will pay.

Man dies during the 7th year.
∴ Number of bonuses = 6
Value of each bonus = 30*s.* × 2 = £3
∴ Value of 6 bonuses = £3 × 6 = £18
Original value of policy = £200

∴ Value of policy at man's death = £218

Example II.—At the age of 30 a man takes out an Endowment Insurance policy for £500 (with profits) which matures at the age of 55. Find what amount he will actually receive, if he lives until that age, and annual bonuses have been declared of 34*s.* per cent.

Number of bonuses = 55 – 30 = 25.
Value of each bonus = 5 × 34*s.* = £8 10*s.*
∴ Value of 25 bonuses = 25 × £8 10*s.* = £212 10*s.*
Original value of policy = £500

∴ Value of fully matured policy = £712 10*s.*

Exercise 38.

1. Find the value of a Whole Life Insurance policy for £100 (with profits) after 17 years, if the annual bonuses have been (*a*) 28*s.* per cent.; (*b*) 30*s.* per cent.; (*c*) 34*s.* per cent.

2. Find the value of an Endowment Insurance policy for £200 (with profits), the annual bonuses on which are 32*s.* per cent., after (*a*) 10 years; (*b*) 14 years; (*c*) 18 years.

3. Find the value, at maturity, of an Endowment Insurance policy for £300 (with profits), payable at the age of 55, in the cases of men who (*a*) take out such a policy at the age of 26; (*b*) take out such a policy at the age of 33; (*c*) take out such a policy at the age of 40. (Assume that the annual bonuses are at the rate of 29*s.* per cent.)

Exercise 39.

Miscellaneous Examples on Chapters X. and XI.

1. Find (to the nearest penny) what sum £18 13*s*. 11*d*. will amount to in 3 years at 4 per cent. compound interest.

2. Find (to the nearest penny) what sum £21 5*s*. 6*d*. will amount to in 4 years at 7 per cent. compound interest.

3. Find (to the nearest penny) what sum annual premiums of £7 17*s*. 6*d*. will amount to in 3 years at 5 per cent. compound interest.

4. Find (to the nearest penny) what sum annual premiums of £4 18*s*. will amount to in 4 years at 4 per cent. compound interest.

5. Using Table VIII., find to the nearest shilling what sum annual premiums of £12 will amount to in 21 years at 3 per cent. compound interest.

6. Using Table VIII., find to the nearest shilling what sum annual premiums of £8 will amount to in 28 years at 2½ per cent. compound interest.

7. Using Table VIII., find to the nearest shilling what sum annual premiums of £2 will amount to in 27 years at 3 per cent. compound interest.

8. Using Table VIII., find to the nearest shilling what sum annual premiums of £3 6*s*. will amount to in 25 years at 2½ per cent. compound interest.

9. Find the total amount paid in premiums by a man who insures himself for £34 8*s*. just before the age of 25, if he lives to the age of 60. (Use Table IX. for Examples 9 to 12.)

10. How much less will be paid in premiums than will be paid out at death in the case of a man who starts to pay 4*d*. per week for Insurance just before the age of 20, and lives beyond the age of 60 ?

11. A boy starts to pay 6*d*. per week for Insurance just before reaching the age of 15. How much less will he pay in premiums than the Insurance Company will pay at his death, if he survives to the age of 60 ?

12. How much more will be paid out by the Insurance Company than is received in premiums in the case of a man who starts to pay 5*d*. per week just before reaching the age of 30, and lives 12 years ?

13. How much is a £200 Whole Life Insurance (with profits) worth after 22 years, if the annual bonuses are at the rate of 25*s*. per cent.?

14. Find the value of an Endowment Insurance policy (with profits) for £300, after 25 years, if the annual bonuses are at the rate of 30*s*. per cent.

15. Find the value at maturity of an Endowment Insurance policy for £200 (with profits) taken out at the age of 30 and payable at the age of 55, if the annual bonuses are at the rate of 29*s*. per cent.

CHAPTER XII

INCOME TAX

56. What Income Tax is.—Up to the present we have dealt with two different kinds of expense which every individual has to meet. These are *personal expenses*, such as those on food, clothes, rent, and insurance; and *district expenses*, which we pay for in the rates. In addition to these, we all have to share certain *national expenses*. Two of the best known of these are the costs of keeping up our Army and Navy. A full statement of our income and expenditure as a nation will be given later on in Chapter XV.

These national expenses are met in a variety of ways, one of the chief of which is by means of what is known as *Income Tax*. This is a tax upon the yearly income of every individual in the country who earns or receives more than a certain amount. By taxing the income in this way it is possible to share the cost of the national services among the members of the nation, so that everyone pays according to his ability.

57. Assessable Income.—Income Tax is reckoned as so much in the £. Table XI. shows how the Income Tax rate has varied during the past few years. The present high rate is due to the tremendous cost of the war.

Income Tax is not charged upon all incomes, nor upon the whole of any income. It is recognized that when incomes are very small it would either be impossible to collect a tax, or the cost of collection would be greater than the amount of tax collected. Incomes below a certain limit are, therefore, exempt from taxation, and for similar reasons a certain portion of each taxed income is also exempt. The way in which this is worked is by allowing deductions from the total income according to a definite scale, the resultant figure—the *taxable income*—being the amount on which tax is actually paid.

The first deduction is *one-sixth of the earned income*.* If we make this deduction we get what is called the *assessable income*. This is the starting-point in reckoning Income Tax. If a man earns £600 per year his assessable income will thus be £600 – £100 =

* *Earned income* is money received in wages or salary for the doing of work. *Unearned income* consists of all income drawn from such sources as rent, interest, and dividends upon investments.

The maximum allowance for earned income is £250, which means that all earned incomes of £1,500 or more per year are allowed a uniform deduction of £250 in arriving at the assessable income.

TABLE XI.

*Rates of Tax on Each Pound of Taxed Income.

Total Income.	1909-13.		1914-15.		1915-16.		1916-18.		1918-20.	
	Earned.	*Unearned.*	*Earned.*	*Unearned.*	*Earned.*	*Unearned.*	*Earned.*	*Unearned.*	*Earned.*	*Unearned.*
	s. d.	*s. d.*	*s. d.*	*s d.*	*s d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
£130 to £160	Exempt	Exempt	Exempt	Exempt	1 $9\frac{3}{5}$	2 $4\frac{4}{5}$	2 3	3 0	2 3	3 0
160 to 300	0 9	1 2	1 0	1 4	1 $9\frac{3}{5}$	2 $4\frac{4}{5}$	2 3	3 0	2 3	3 0
300 to 500	0 9	1 2	1 0	1 $6\frac{2}{5}$	1 $9\frac{3}{5}$	2 $9\frac{3}{5}$	2 3	3 0	2 3	3 0
500 to 1,000	0 9	1 2	1 0	1 8	1 $9\frac{3}{5}$	3 0	2 6	3 6	3 0	3 9
1,000 to 1,500	0 9	1 2	1 2	1 8	2 $1\frac{1}{5}$	3 0	3 0	4 0	3 9	4 6
1,500 to 2,000	0 9	1 2	1 4	1 8	2 $4\frac{4}{5}$	3 0	3 8	4 6	4 6	5 3
2,000 to 2,500	1 0	1 2	1 $6\frac{2}{5}$	1 8	2 $9\frac{3}{5}$	3 0	4 4	5 0	5 3	6 0
2,500 to 3,000	1 0	1 2	1 8	1 8	3 0	3 0	5 0	5 0	6 0	6 0
Over £3,000 ..	1 2	1 2	1 8	1 8	3 0	3 0	5 0	5 0	6 0	6 0

* The following abatements were allowed until 1915:

£160 from incomes not exceeding £400; £150 from incomes over £400, but not exceeding £500; £120 from incomes over £500, but not exceeding £600; £70 from incomes over £600, but not exceeding £700. From 1916 to 1920 the abatements were: £120 from incomes over £130, but not exceeding £400; £100 from incomes over £400, but not exceeding £600; £70 from incomes over £600, but not exceeding £700.

Incomes not exceeding £160 were exempt from taxation until 1915. From 1915 to 1920 incomes not exceeding £130 were exempt.

In 1920 the basis of taxation was changed. 6*s*. in the £ became the standard rate for earned and unearned incomes, but an allowance of 10 per cent. was made from earned incomes to obtain the assessable income. The standard rate was reduced in 1922 to 5*s*., in 1923 to 4*s*. 6*d*., and in 1925 to 4*s*. In 1925 the earned income allowance was increased to one-sixth.

£500 per year. If his income is £600 per year, and is unearned, the assessable income will be the same as the real income—*i.e.*, £600 per year.

Example I.—A man's income is £450 per year, £300 being salary and £150 income from investments. What will be his assessable income ?

Total income	=£450
Less one-sixth of £300	= 50
∴ Assessable income	=£400

Example II.—A man earns £250 per year. He receives in addition £60 per year rent from property which he owns and £50 per year interest on War Loan. What is his assessable income ?

Total income=£250+60+50	=£360
Less one-sixth of £250	= 41 13*s.* 4*d.*
∴ Assessable income	=£318 6*s.* 8*d.*

Exercise 40.

Find the assessable incomes in the following cases:

1. Men who earn (*a*) £225; (*b*) £190; (*c*) £475; (*d*) £725 per year.
2. Men who earn (*a*) £5; (*b*) £6 10*s.*; (*c*) £7; (*d*) £10 10*s.* per week.
3. A man who receives £125 per year in rents and has £250 per year interest on investments.
4. A man who earns £300 per year and has £45 per year rent from a house which he owns.
5. A man who earns £650 per year, and, in addition, has a house which brings him in £70 per year, and investments which bring in £120 per year.
6. A man who earns £5 10*s.* per week and receives £55 per year rent from house property.
7. A mine owner who draws a royalty of 6*d.* per ton on 15,000 tons of coal per annum, and receives £2,200 in dividends on investments.
8. A man who earns £275 per year and has £120 a year interest from investments.

58. Taxable Income.—Still further reductions are made from a man's *assessable income* before we arrive at the actual amount upon which he pays Income Tax. These allowances, as they are called, are as follows:

(*a*) *A personal allowance* of £135 for a single person, and £225 for a married couple.

(*b*) *A children's allowance* for every child under the age of 16. This allowance is £60 for the first child, and £50 for each of the others.*

(*c*) *A dependent relative's allowance* of £25. This is made if the

* No deduction is made, however, in the case of a child who is entitled in his or her own right to an income of more than £60 a year.

taxpayer keeps a relative of himself or his wife. (But the relative must be a widowed mother or mother-in-law, or else incapable of keeping himself or herself owing to old age or infirmity. There is the further condition that the relative must not have a separate income of more than £50 a year.)

(*d*) *A housekeeper's allowance of* £60 is made in the case of a widow or widower who has a housekeeper to take charge of the children and who would otherwise be able to claim a personal allowance of only £135.

(*e*) *A wife's allowance*, in addition to the personal allowance, is made if the wife goes out to work. When this is the case, the wife's earnings are added to the husband's, and both are treated as a single income. An extra allowance is made, however, of $\frac{5}{6}$ of the *wife's earned income, but the maximum allowance made in this way is* £45.

When all of these allowances have been deducted from the assessable income, we arrive at the *taxable income* upon which Income Tax is actually paid. If the allowances exceed the assessable income, no tax is paid at all.

Note.—Do not forget to find the assessable income before making the deductions necessary to arrive at the taxable income.

Example I.—A single man, earning £300 per year, lives with his widowed mother, whom he keeps. Find his taxable income.

Total income	=	£300
Less one-sixth of £300	=	50
Assessable income	=	£250

Allowances :

(1) For man himself, as a single person	=	£135
(2) For dependent relative	=	25
Total deductions	=	£160
∴ Taxable income	=	£90

Example II.—A married man, with 3 children under 16, earns £420 per year and has £40 a year from investments. What is his taxable income ?

Total income = £420 + 40	=	£460
Less one-sixth of £420	=	70
Assessable income	=	£390

Allowances : (1) Married allowance	=	£225
(2) Children's „	=	60, 50, 50
Total deductions	=	£385
∴ Taxable income	=	£5

EXERCISE 41.

Find the taxable incomes in the following cases:

1. Married men with no children who earn (*a*) £470; (*b*) £350; (*c*) £375; (*d*) £450 per year.

2. Married men with one child who earn (*a*) £4 10*s*.; (*b*) £7 10*s*.; (*c*) £6; (*d*) £8 per week.

3. Single men with no dependants who earn (*a*) £250 per year; (*b*) £5 per week.

4. A married man with no children who has £325 per year unearned income.

5. A single man who earns £400 per year and has £40 a year coming in from interest on oil shares.

6. A married man who earns £425 per year and has 2 children under 16.

7. A single man who has property which brings him in £125 per year and earns an additional £350 per year, and who maintains a widowed mother.

8. A married man who earns £320 per year himself and whose wife earns £3 per week. They have one child under 16.

9. A married man who earns £600 per year and has three children under 16, and also maintains a widowed mother.

59. Calculation of Income Tax.—When the taxable income is known, it is quite a simple matter to work out the Income Tax which has to be paid. At the time of writing this chapter,* the standard rate of Income Tax is 4*s*. in the £. The full tax is not, however, payable upon the whole of the taxable income.

(*a*) On the first £225 of the *taxable income*, a tax of only half the standard rate, or 2*s*. in the £, is payable.

(*b*) On all taxable income above £225, the full rate of 4*s*. in the £ is charged.

Example I.—Find the Income Tax to be paid by a man whose taxable income is £352.

Taxable income=£352 0*s*. 0*d*.

		£	s.	d.
Tax on £225 at 2*s*. in the £	=	22	10	0
" £352 - £225—*i.e.*, on £127 at 4*s*.	=	25	8	0
∴ Total tax payable	=	£47	18	0

* The standard rate of Income Tax was reduced from 4*s*. 6*d*. to 4*s*. in the pound in 1925-6.

Example II.—A married man, with 3 children under 16 years of age, earns £500 per year and has £300 per year unearned income. How much Income Tax should he pay per year?

		£	s.	d.
Total income	=	800	0	0
Less one-sixth of £500	=	83	6	8
∴ Assessable income	=	716	13	4

Deductions :

Married allowance	= £225				
Children's ,, (60+50+50)	= 160				
Total deductions		=	385	0	0
∴ Taxable income		=	331	13	4

		£	s.	d.
£225 at 2*s.* in the £	=	22	10	0
£106 13*s.* 4*d.* at 4*s.* in the £	=	21	6	8
∴ Total tax payable	=	43	16	8

EXERCISE 42.

Find the Income Tax payable by the following men:

1. A single man earning £300 per year with no dependants.

2. A single man earning £600 per year with an infirm father dependent on him.

3. A married man earning £450 per year with (*a*) 1 child under 16; (*b*) 2 children under 16; (*c*) 3 children under 16.

4. A married man earning £300 per year and a wife earning £150 per year, but with no children under 16.

5. A widower earning £500 per year with 2 children under 5 and a housekeeper.

6. A single man earning £5 per week with a mother dependent on him.

7. A married man with no children and earning £5 15*s.* per week.

8. A married man with 2 children under 16 and earning £6 10*s.* per week.

9. A married man with 1 child under 16, earning £250 per year, in addition to £125 per year received from house property.

10. A single man with no dependants, earning £200 per year and receiving £170 from investments.

60. Allowance for Insurance Premiums.—From the tax, calculated as above, one further allowance can be claimed. If the man has insured his life or his wife has insured hers, then a deduc-

tion may be made from the tax at the rate of 2*s.* in the £ on the insurance premiums paid during the year.*

Example I.—A man insures his own life at a premium of £25 per year and his wife's life at a premium of £15 per year. How much Income Tax will he save ?

Total insurance premiums=£25+15=£40.
∴ Tax saved=40×2*s.*=£4.

Example II.—A married man with no children earns £400 per year and pays insurance premiums upon his own life and that of his wife totalling £30 per year. How much Income Tax will he have to pay ?

		£	s.	d.
Total income	=	400	0	0
Less one-sixth of £400	=	66	13	4
∴ Assessable income	=	333	6	8
Less married allowance	=	225	0	0
∴ Taxable income	=	£108	6	8
Tax=$108\frac{1}{3}\times 2s.$	=	10	16	8
Deduct insurance allowance =2*s.* in £ on £30	=	3	0	0
∴ Income tax payable	=	£7	16	8

Example III.—A man has taken out, at various times, three policies for Life Insurance. The premiums upon the first are 17*s.* 8*d.* per quarter, upon the second they are £1 18*s.* 3*d.* per quarter, and upon the third they are £42 8*s.* 6*d.* per year. What saving (to the nearest penny) will he effect in his Income Tax ?

NOTE.—*The Income Tax returns, in reckoning premiums, only take into account the whole number of shillings. The pence are neglected.*

Premium on first policy=17*s.* 8*d.*×4 per year	=	£3	10*s.*
,, ,, second ,, =£1 18*s.* 3*d.*×4 ,,	=	7	13*s.*
,, ,, third ,, =£42 8*s.* 6*d.* ,,	=	42	8*s.*
Total (neglecting pence)	=	£53	11*s.*

2*s.* in the £=$\frac{1}{10}$ of £53 11*s.*
∴ Saving at 2*s.* in the £=£5 7*s.* 1*d.* (to nearest penny).

* In cases where an insurance policy was taken out on or before June 22, 1916, an allowance of 3*s.* in the pound can be claimed, if the total income exceeds £1,000, but does not exceed £2,000; and an allowance of 4*s.* in the pound if the total income exceeds £2,000. In our examples we shall assume the allowance to be 2*s.* in the pound

Exercise 43.

What saving will be effected in Income Tax by men who have taken out the following insurances ?

1. A man who has insured his own life at an annual premium of £17.
2. A man who has insured his life at a premium of £5 15*s.* per quarter.
3. A man who pays £21 per year on his own life and £1 10*s.* per quarter upon his wife's life.
4. A man who has two insurances on his own life, the premiums upon which are £18 per year and £3 5*s.* per quarter.
5. A man who pays annual premiums of £18 18*s.* 3*d.*
6. A man who pays quarterly premiums of £7 15*s.* 3*d.* on his own life and half-yearly premiums of £1 3*s.* 6*d.* upon his wife's life.

How much Income Tax will be paid in the following cases ?

7. A single man earning £300 per year, with no dependants, who has insured his life by paying annual premiums of £15.
8. A married man with no children who earns £350 per year, and has insured his own life by paying annual premiums of £20 and his wife's by paying quarterly premiums of £1 5*s.*

61. Half-Yearly Assessments.—Manual workers have to make a half-yearly return of income and are required to pay tax half-yearly.

A manual worker is entitled to all the *allowances* mentioned on pp. 73-74. For the purpose of working out the half-yearly tax, these allowances are divided by 2, and the sums thus obtained are deducted from the half-year's income. The allowances, therefore, become as follows, when reckoned per half-year:

(*a*) *Personal allowance :* £67 10*s.* for a single person and £112 10*s.* for a married couple.

(*b*) *Children's allowance :* £30 for first child, £25 for each of the others.

(*c*) *Dependent relative's allowance :* £12 10*s.*

(*d*) *Housekeeper's allowance :* £30.

(*e*) *Wife's allowance :* $\frac{5}{6}$ of earnings, but not more than £22 10*s.*

In addition, an allowance is frequently made for the cost of replacing tools. Another allowance, to correspond with the allowance on insurance premiums, is based on that part of contributions to Friendly Societies and Trade Unions which is taken to be the cost of superannuation and death benefits.

Example.—An engineer earns £216 in 6 months. He is married, with two children under 16, and pays 1*s.* 6*d.* per week insurance for himself and 1*s.* per week for his wife. He also pays contributions to a Trade Union and to a Friendly Society, of which 1*s.* per week may be considered the cost of superannuation and

death benefits. How much Income Tax should he pay for that half-year ?

		£	s.	d.
Income for half-year	=	216	0	0
Deduct one-sixth	=	36	0	0
Assessable income	=	180	0	0

Allowances :

		£	s.	d.
Married	=	112	10	0
First child	=	30	0	0
Second child	=	25	0	0

		£	s.	d.
Total allowances	=	167	10	0
Taxable income	=	12	10	0

Tax on £12 10 0*d*. at 2*s*. in the £ $= \frac{1}{10}$ of £12 10*s*. 0*d*.
= £1 5*s*. 0*d*.

Deduct tax on contributions to Insurances, Trade Unions, and Friendly Societies:
$=26 \times (1s. 6d. + 1s. + 1s.) = 26 \times 3s. 6d.$
=£4 11*s*. at 2*s*. in the £.
$= \frac{1}{10}$ of £4 11*s*. = 9*s*. 1*d*.

Tax payable for half-year = £0 15*s*. 11*d*.

62. Repayment of Income Tax.—It sometimes happens that a man's wages, on account of overtime and short time, vary considerably from time to time. Thus for six months he may earn so much that he has to pay Income Tax, while for the rest of the year his income may be so low that no Income Tax can be claimed from him. When this happens it usually means that the man can actually *claim to have refunded to him a portion of the Income Tax paid* during the half-year when his wages were high.

Whether there is anything to be claimed, and, if so, how much, can easily be discovered. At the end of the year the amount due as Income Tax for the year's earnings must be worked out. Any tax paid in excess of this can be reclaimed. The next example shows clearly how this can be estimated.

Example.—A married man, with no children under 16, earns £159 in the first half-year and £115 in the second half-year. How much tax will he pay at the end of the first half-

year, and how much will he be able to reclaim at the end of the year ?

	First Half-Year.			Second Half-Year.			Total.		
	£	s.	d.	£	s.	d.	£	s.	d.
Income	159	0	0	115	0	0	274	0	0
Less one-sixth earned income	26	10	0	19	3	4	45	13	4
Assessable income	132	10	0	95	16	8	228	6	8
Deduct married allowance ..	112	10	0	112	10	0	225	0	0
Taxable income	20	0	0	No taxable income			3	6	8
Tax payable at 2*s.* in the £ ..	2	0	0	None			0	6	8

		£	s.	d
Tax paid for the first half-year	=	2	0	0
Tax payable for year	=	0	6	8
∴ Amount to be reclaimed	=	1	13	4

Exercise 44.

How much Income Tax will be paid by the following manual workers for the half-year mentioned ?

1. A single man, with no dependants, who earns £84 during the half-year.

2. A single man, with a mother dependent on him, who earns £102 during the half-year.

3. A married man, with no children, who earns £152 during the half-year.

4. A married man, with 1 child, who earns £192 during the half-year.

5. A single man, with no dependants, who earns £104 during the half-year, and pays £2 per quarter insurance premiums.

6. A married man, with no children under 16, who earns £160 during the half-year, and pays £1 10*s.* per quarter insurance premiums.

How much Income Tax can be claimed to be repaid at the end of the year in the following cases ?

7. A single man, who earns £83 in the first half-year and £71 in the next half-year.

8. A single man, with a dependent mother, who earns £108 in the first half-year and £92 in the next half-year.

9. A married man, with no children, who earns £147 in the first half-year and £132 in the next half-year.

10. A married man, with 3 children, who earns £246 during the first 6 months of the year, and £222 during the next 6 months.

CHAPTER XIII

RUNNING A BUSINESS

63. Purposes of a Business.—In this chapter we shall look into the working of a business from the point of view of the proprietor or owner, who is the employer of the workers whose wages and salaries we dealt with in Chapter I.

All businesses are run with two purposes: (*a*) They must *serve some public need.* For instance, a *manufacturing* business aims at making some article or articles for which there is a general demand.

(*b*) Businesses also aim at *making a profit.* They could not continue to run unless the proprietor received more money from the sale of his goods than it cost him either to make or to buy them.

64. Profits.—There are many wrong ideas as to what profit really is. For instance, a greengrocer buys his fruit and vegetables in quantities at a *wholesale price,* and sells them to his customers at a higher *retail price;* and it is often thought that the difference between the wholesale and retail prices is the greengrocer's profit. This is, indeed, called the *gross profit,* but the greengrocer always has expenses to pay out of his gross profit, and his *net profit,* which is his *real income,* is considerably less than the gross profit.

65. A Business Budget.—We can most readily appreciate the difference between gross and net profit and the various classes of expenses that have to be met in conducting a business by considering a simple budget of income and expenditure, such as a business man might draw up if he wished to know what his profit was likely to be under certain conditions.

Let us suppose that a greengrocer is doing a trade of £45 per week, and that he is working on the principle of adding a gross

profit of 50 per cent. to the wholesale price of his goods. If this were the case, his goods would cost him £30 per week, leaving him a gross profit of £15.

The following account shows the sort of budget he would draw up in attempting to forecast his net weekly profit:

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
Sales	45	0	0	Wholesale cost ..	30	0	0
				Rent and rates ..	1	15	0
				Wages of assistant	2	10	0
				,, ,, boy ..	0	17	6
				Cost of keeping van	2	2	6
				Lighting	0	10	0
				Bad debts	0	5	0
				Net profit	7	0	0
Total	£45	0	0	Total	£45	0	0

His net profit is thus seen to be £7 per week, although his gross profit is £15.

Inspection of such an account tells a business man several important things:

(*a*) The total weekly expenses are £8. It is necessary, therefore, to make at least £8 gross profit per week before the business begins to pay.

Now £15 is the gross profit on a turnover of £45.

$\therefore$ £8 is the gross profit on a turnover of $£\frac{45 \times 8}{15} = £24$.

The business will not pay unless its turnover is over £24. If the turnover dropped below £24 per week it would be possible to make the business profitable only by raising the rate of gross profit, or by cutting down expenses.

(*b*) We have assumed that the greengrocer sells the whole of the goods which he buys, at 50 per cent. gross profit on the wholesale price. Suppose, however, that he is selling perishable goods, and that he buys more than he can sell at his ordinary prices during any particular week. Then it will happen either that he sells his surplus stock at a reduced price, in order to get rid of it, or that a certain quantity will become worthless and have to be thrown away. In either case he would not obtain the full amount of money which we have reckoned in our budget. Thus

he might buy £30 worth at the wholesale price, and only get £40 for it. He would still have his £8 per week expenses to pay, and his net profit would be only £2.

Example I.—A man has a business in which the retail prices are 25 per cent. more than the wholesale prices. If his expenses are £12 per week, what must be his weekly turnover, if he wishes to make £5 per week net profit?

$$\begin{aligned} \text{Net profit} &= £5 \\ \text{Expenses} &= £12 \\ \therefore \text{Gross profit} &= £17 \end{aligned}$$

What he buys at £100 he sells at £125

∴ £25 = gross profit on a turnover of £125

and £17 = ,, ,, ,, ,, ,, $£\frac{125 \times 17}{25}$

= £85 per week.

Example II.—A builder works at a gross profit of 20 per cent. on the cost of his work. He does work during a certain year for which he charges £4,500. What net profit does he make for the year, if his running expenses are £7 per week? Find also what per cent. of his turnover his net profit amounts to.

He charges £120 for work which costs him £100.

So on £120 of work he makes gross profit = £20

∴ On £4,500 ,, ,, ,, ,, $= £\frac{20 \times 4{,}500}{120}$

= £750

Running expenses = £7 per week = £364 per year.

∴ Net profit for the year = £386

Net profit on £4,500 = £386

∴ ,, ,, ,, £100 = $\frac{386}{45}$ = 8·6 per cent. (to 1st dec. place).

Exercise 45.

1. A butcher reckons to make 40 per cent. gross profit on the wholesale price of his meat. Find his net profit if his average weekly turnover is £70 and his weekly expenses are £8 10*s*.

2. A grocer makes 25 per cent. gross profit on his wholesale costs. What trade must he do per week in order just to cover his weekly expenses of £12?

3. An ironmongor makes 50 per cent. gross profit on the wholesale prices of his goods. What must his weekly turnover be to pay his expenses of £11 and give him a net profit of £7 per week?

4. A builder works at a gross profit of 25 per cent. on the cost of his work. What will be his net profit for a year in which he does work to the value of £5,000, if his weekly expenses are £8 ?

5. A baker makes 40 per cent. gross profit on the wholesale price of his materials. What trade must he do per week in order just to cover his expenses of £12 per week ?

6. A man is in a business where he can get $33\frac{1}{3}$ per cent. gross profit on the wholesale prices of his goods. If his weekly turnover is £60, what net profit will he make, assuming that his weekly expenses are £7 10*s*. ?

7. What weekly trade must the grocer in Example 2 do in order to make £6 per week net profit ?

8. What amount of work must the builder in Example 4 do per annum to receive a net profit of £300 per year ?

66. Capital.—It is impossible to set up even a small business without a certain amount of capital. If a new business is to be started, money will be required to furnish the business premises, to buy stock, to advertise the new venture, and to stand any losses during the first few weeks or months of running. If the business is to carry on a manufacturing process, it will probably be necessary to build a factory, to purchase costly machinery and fix it, and to provide the money for the purchase of raw materials and the provision of a reserve fund to meet emergencies.

This capital always comes out of someone's savings—money received as wages, salaries, or profits from some other business, and saved ready to be invested in some business enterprise.

If an old business is being purchased, money will be required to buy any lease that exists on the business premises, to purchase the stock and the book debts, as well as to provide the money necessary for any extension of premises or plant. A certain sum will have to be paid also for what is called the "*goodwill*" of the business. If a business is already a profitable concern it is worth a considerable sum of money to acquire the connection it has built up with its customers. Thus the goodwill of a business making a profit of £500 per year might be worth as much as £1,000; while the goodwill of a business making a profit of £3,000 per year might easily be worth as much as £8,000 or £10,000. This cost is in addition to the value of the business premises, machinery, and stock.

Example I.—A man buys a grocer's business. He pays £500 for the goodwill, and agrees to buy the stock and debts owing by customers at a 10 per cent. discount. The stock is valued at £120, and the customer's debts amount to £50. How much

capital will he require to take over the business if he wishes to allow himself £200 for developments ?

Value of stock	=£120
Customers' debts	= 50
	£170
10 per cent. discount	= 17
Balance to be paid	=£153
Cost of goodwill	= 500
Required for developments	= 200
Total capital required	=£853

Exercise 46.

Find the capital required to take over the following businesses:

1. A newsagent's business, the goodwill of which is £250. The stock and book debts which must be paid for in full are valued at £50. It is estimated that £40 must be spent in decorating and fitting out the shop, and it is desired to allow a reserve of £100 for emergencies.

2. A draper's business, the goodwill of which is £2,000. The stock amounts to £750, the lease of the premises must be bought for £1,200, and £1,000 is required for the extension of the business.

3. A manufacturing business, the machinery and premises of which are valued at £10,000. The goodwill is worth £7,000, the stock amounts to £1,600, and the book debts to £2,200. A discount of 5 per cent. is allowed on the stock and debts.

4. A hairdresser's business, the goodwill of which is valued at £150. The shop fittings are valued at a further £45, and the stock amounts to £20. An allowance of 25 per cent. is made on the value of the stock.

Find the capital required to set up in the following businesses:

5. A business for which premises have to be bought at a price of £1,200. The stock will cost £250, and a further £450 should be allowed for developing the business.

6. A business the running expenses of which will be £8 per week. Premises can be obtained on a weekly rental, which is included in the £8 for running expenses, but £100 will be spent in fitting them up. Stock will cost £750, and sufficient money should be in hand to pay the weekly expenses for six months.

7. A manufacturing business, which will need to buy a building site for £2,000, build a factory at a cost of £11,000, put in machinery to cost £7,500, and provide £4,000 as a reserve for running expenses.

8. A small retail business, which entails fitting up a shop at a cost of £35, buying stock at a cost of £40, a pony and cart at a cost of £45, and providing a reserve of £50 to meet losses during the first few weeks of running.

67. Limited Liability Companies.—It is not many years since the great majority of business firms were owned and con-

trolled by individuals, working either alone or in partnership. In those days the owner himself provided the capital and managed the business. Nowadays most big businesses, and indeed a great number of smaller businesses, are owned by what are called *limited liability companies.*

The words "*limited liability*" are very important. Indeed, the great increase in recent years in the number of limited liability companies is almost entirely due to the significance placed by the law upon these words. Before the days of the limited company, anybody who accepted a partnership in a business firm pledged his whole fortune upon the success of the firm. If the firm proved a failure, and lost money heavily, the partner sometimes had to sell all his private possessions in order to meet its debts.

All this has been changed by the introduction of limited liability companies. What such a company means we can most easily understand by looking at the announcement such as appears in a daily newspaper of the formation of one. The part of the announcement in which we are most interested always appears at the head of the prospectus, and in a very simple example it would be somewhat as follows:

THE A.B.C. MANUFACTURING COMPANY, LIMITED

(*Incorporated under the Companies Acts,* 1908 *to* 1917.)

AUTHORISED SHARE CAPITAL .. £250,000.

Divided into
250,000 shares of £1 each.

Issue of
150,000 shares of £1 each, of which 130,000 are
now offered for Subscription at par.

PAYABLE AS FOLLOWS:

	£	s.	d.	
On application	0	2	0	per share
On allotment	0	3	0	,,
On March 31, 1922	0	5	0	,,
On May 31, 1922	0	5	0	,,
On July 31, 1922	0	5	0	,,
	£1	0	0	

After this announcement we are told who are the Directors and other officials of the company. Then follows a description of the

company, giving particulars of the purpose of the company, the kind of business it intends to undertake, its possibilities of success, and an estimate of its profits.

Our main interest just now, however, is to understand the meaning of the word *Limited* as applied to such a company. The particulars given above tell us the following facts about the company:

(*a*) The maximum capital that can be issued by the company as it stands is £250,000.

(*b*) At present only £150,000 capital is going to be issued. £20,000 of this, as the prospectus will show, has been already taken up by the Directors.

(*c*) The other £130,000 capital is offered for what is called *public subscription*. Anyone who has money to spare can offer to invest it in the company. The capital is divided into £1 shares, so if I decide I should like to invest £50 in the company I apply for fifty £1 shares.

(*d*) For every £1 share I ask for I must send 2*s*. as a first instalment to the Bankers of the company.

(*e*) When all the applications have been received shares are *allotted*. It may happen that more than 130,000 shares are applied for. In this case, each person who applies will receive a proportion of the shares he asked for.

(*f*) If a man is allotted the full number of shares he asks for, he promises to pay the rest of the money by instalments. He must pay 3*s*. per share as soon as the shares are allotted to him, and three instalments of 5*s*. each per share at two-monthly intervals afterwards.

(*g*) As it is a limited company, every shareholder's liability is *limited* to the face value of the shares which he holds. If he holds only one share, and has paid the £1 for it, the most he can lose is that £1. If the Company fails it is not possible for him to be called upon to pay any more, no matter how rich he may be.

68. Ordinary and Preference Shares.—In the case we have just considered the shares issued are what are called *Ordinary shares*. In such a case the net profits of the company would be divided equally among the shareholders. Many companies, however, have *Preference shares* as well as *Ordinary shares*.

Preference shares are those which have the right to a stated share of the profits before other shares are allowed to participate at all. Suppose that the shares are called 7 per cent. preference shares. In this case, provided the profits are large enough in any year, 7 per cent. must be paid on the preference shares before any dividend whatever may be paid on any other shares.

Usually preference shares are *cumulative*, and they are frequently known as *Cumulative Preference shares*. The effect of this is that if the profits are insufficient in any year to pay the fixed percentage on the preference capital, then the amount unpaid must be carried forward to the next year; and all arrears of preference dividends must be paid before other classes of shares are entitled to any dividend at all.

Ordinary shares are those which take the surplus profits after the preference shares have been paid their guaranteed rate of interest. If the profits are high, therefore, it is quite a common occurrence for the ordinary shares to receive a high rate of dividend, while the preference shares can still claim no more than their fixed rate. If the profits are low, however, the preference shares have the advantage.*

Example.—A company has issued £150,000 7 per cent. preference shares and £200,000 ordinary shares. In a given year it distributes profits among its shareholders amounting to £34,500. What is the rate of dividend which is paid on the ordinary shares ?

Total profits shared	= £34,500
7 per cent. on £150,000 preference shares	= 10,500
Balance for ordinary shares	= £24,000
Dividend on £200,000 ordinary shares	= £24,000
∴ „ „ £100 „ „	$= £\frac{24,000}{2,000} = £12$
	= 12 per cent.

Exercise 47.

1. A company is formed with £350,000 ordinary shares. What rate of interest is it likely to pay, if its estimated profits are (*a*) £28,000 per year; (*b*) £26,250; (*c*) £33,250 ?

2. A company has issued £100,000 8 per cent. preference shares and £50,000 ordinary shares. What total net profit must it make per year in order to pay 10 per cent. on its ordinary shares ?

3. A company starts with £150,000 of 7 per cent. preference shares and £100,000 ordinary shares. If it decides to distribute net profits of £19,500 at the end of the first year, what rate of dividend will be paid to the holders of ordinary shares ?

4. A company has £500,000 of 7 per cent. preference shares, £100,000 of 8 per cent. preference shares, and £72,000 ordinary shares. What rate of dividend will be paid to the holders of ordinary shares for a year

* Many companies also have what are called *Deferred shares*. Such shares are not entitled to any dividend until a fixed rate of dividend has been paid to the ordinary shareholders. Usually the surplus profits are then used in: (*a*) Paying up to a fixed rate of dividend on the deferred shares; and (*b*) if there is any surplus, after doing this, it is divided between the ordinary and deferred shares.

at the end of which total net profits of £54,520 are distributed to shareholders ?

5. What net profits are necessary for a company to pay a $12\frac{1}{2}$ per cent. dividend on £275,000 ordinary shares as well as the dividend on £150,000 6 per cent. preference shares ?

6. What are the net profits of a company that pays a dividend of 15 per cent. on £175,000 ordinary shares, a 7 per cent. dividend on £225,000 preference shares, besides putting away £35,000 to its reserve fund ?

69. Value of Shares.—In the case of industrial companies, the shares are usually £1 shares. As a rule, these shares are issued *at par*, which means that the price paid is equal to the *nominal value*—that is, £1. Occasionally, when a company advertises for additional capital, shares are offered at a price which differs from the nominal value. If the price is above the nominal value, the shares are said to be offered "*at a premium*"; if below, they are said to be offered "*at a discount.*"

It is not only, however, when a company is formed that one can buy its shares. When so many people have capital in a limited company, there will always be people who wish to dispose of their shares. There is, in fact, a regular business of buying and selling shares, which is conducted by what is called the *Stock Exchange.*

It is very rarely that shares are sold at a price exactly equal to their nominal value. The price of shares varies according to the dividends paid, and the general prospects and soundness of the company, since these affect the demand for such shares. Suppose, for instance, that a dividend of 20 per cent. has been paid upon the £1 ordinary shares of a company for several years and that the company has every appearance of being in a flourishing condition. Then the £1 shares will be in great demand and may therefore fetch as much as £2 or £3 each.

The prices at which shares are sold are given in the financial columns of our newspapers every day. Thus the following examples of share prices are taken from *The Times* of February 19, 1922:

TABLE XII.

PRICES OF £1 SHARES ON FEBRUARY 18, 1922.

Aerated Bread Co. ..	27/6	Gordon Hotels.. ..	$2\frac{3}{4}$
Barker	33/6	Lyons	$3\frac{1}{4}$
Brunner Mond	23/6	Maple	$1\frac{7}{32}$
Calico Printing Co. ..	14/9	Marconi..	$1\frac{11}{16}$
Cunard Steamship Co. ..	17/6	Van den Bergh	$\frac{7}{8}$
Dunlop Rubber Co. ..	6/3	Welsbach	$\frac{9}{16}$

It will be noticed that some of these prices are quoted in shillings and pence, and others are given in fractions of £1. The prices given are what we call the *middle prices*. If we wanted to buy these shares it would usually be necessary to give 6*d*. or so more per share than is quoted here. If we wished to sell, the price would be 6*d*. or so less.

In the following examples, however, we shall take both buying and selling prices as being equal to the quoted prices.

Example I.—Find, from Table XII., the cost of 50 £1 shares in the Aerated Bread Company.

Cost of 50 shares $=50\times 27s.\ 6d. = £68\ 15s.$

Example II.—How much should I obtain by selling 100 £1 shares in the Gordon Hotels?

Value of 100 shares $=100\times £2\frac{3}{4} = £275$

Exercise 48.

Take the value of the shares in the following examples from Table XII.

How much would it cost to buy the following shares?

1. 25 £1 shares in Barkers.
2. 250 £1 „ Brunner Monds.
3. 100 £1 „ Lyons.
4. 500 £1 „ Maples.

If I bought the shares *at par*, how much should I gain or lose by selling the following shares?

5. 300 £1 shares in the Dunlop Rubber Company.
6. 100 £1 „ Marconis.
7. 50 £1 „ Welsbachs.
8. 150 £1 „ the Cunard Steamship Company.
9. 230 £1 „ Gordon Hotels.
10. 150 £1 „ Maples.
11. 500 £1 „ Lyons.
12. 25 £1 „ Van den Berghs.

70. Yield of Shares.—The rate of interest which a man receives on the money which he invests in a company will depend upon:

(*a*) The *dividend* paid on the shares.
(*b*) The *price* which he paid for the shares.

In calculating the *yield* of an investment it must be remembered that the *dividend* is always paid on the *nominal* value of a share.

Example I.—A man paid 42*s.* 6*d.* for £1 shares in a certain company. If the dividend declared is 20 per cent., what rate of interest will he receive on the money which he has invested ?

$$\begin{array}{lll} & \text{Dividend on £100 shares} & = £20 \\ & \text{Cost of £100 shares} & = 100 \times 42s.\ 6d. = £212\tfrac{1}{2}. \\ \therefore & \text{Interest on £}212\tfrac{1}{2} & = £20 \\ \text{and} & \quad ,, \quad ,, \ £100 & = £\dfrac{20 \times 100}{212\frac{1}{2}} = £\dfrac{20 \times 100 \times 2}{425} \\ & & = £\dfrac{160}{17} = 9{\cdot}4 \text{ per cent.} \\ & & \quad \text{(to first decimal place).} \end{array}$$

Exercise 49.

What rate of interest is yielded by the following shares ? (Answers to be given correct to the first decimal place.)

1. 7 per cent. preference shares which cost 21*s.* 6*d.*
2. 7 ,, ,, ,, ,, 19*s.* 3*d.*
3. 6 ,, ,, ,, ,, 18*s.* 9*d.*
4. 6 ,, ,, ,, ,, 15*s.* 6*d.*
5. 8 ,, ,, ,, ,, 22*s.*
6. Ordinary shares costing $3\frac{1}{4}$ which pay a dividend of 40 per cent.
7. Ordinary shares costing 33*s.* 6*d.* which declare a dividend of 18 per cent.
8. Ordinary shares costing 16*s.* which declare a dividend of 7 per cent.
9. Ordinary shares costing 8*s.* 6*d.* which declare a dividend of 3 per cent.
10. Ordinary shares costing 27*s.* 6*d.* which pay a dividend of $12\frac{1}{2}$ per cent.
11. Ordinary shares costing $5\frac{1}{4}$ which pay a dividend of 35 per cent.
12. Ordinary shares costing $2\frac{3}{4}$ which pay a dividend of 28 per cent.

Exercise 50.

Miscellaneous Examples on Chapters XII. and XIII.

1. What is the taxable income of a married man who earns £420 per year and has 1 child under 16 ?
2. What is the taxable income of a single man who keeps his mother and who earns £5 10*s.* per week ?
3. What Income Tax will be paid by a single man with no dependants who earns £300 per year ?
4. How much Income Tax will a married man pay who has 2 children under 16, if his earned income is £7 per week ?
5. What deduction will be allowed from the Income Tax of a man who pays Life Insurance premiums of £2 16*s.* per quarter ?
6. A married man has no children under 16. He earns £375 per year and pays £7 10*s.* per year Life Insurance premiums. What Income Tax will he pay ?

7. How much Income Tax will a single man who is a manual worker have to pay for a half-year during which he earned £96 ?

8. How much Income Tax will a married man who is a manual worker have to pay for the half-year during which he earned £174 ?

9. How much Income Tax will a single man who is a manual worker be able to claim to be repaid at the end of a year in which he earned £102 in the first half-year and £72 in the next half-year ?

10. A builder works at a gross profit of 30 per cent. on the cost of his work. What will be his net profit for a year in which he does work for which he charges £3,900, if his weekly expenses are £4 10*s.* ?

11. A stationer charges a gross profit of $33\frac{1}{3}$ per cent. on the wholesale price of his goods. His trade is £44 per week. What net profit will he make, if his weekly expenses are as follows: Rent, £1 5*s.*; rates, 11*s.* 3*d.*; gas, 5*s.* 9*d.*; wages, £1 15*s.* ?

12. A costermonger reckons to make a gross profit of 20 per cent. on the wholesale cost of his goods. What will be his net profit for a week in which his total takings are £32 2*s.*, if his weekly expenses are £1 16*s.* ?

13. What capital would be required to take over a business already running, if the goodwill is valued at £320, and the stock is worth £125 ? A discount of 10 per cent. is allowed off the value of the stock, and it is estimated that a further £150 would be required for running expenses and to meet the need for extensions.

14. A limited company is formed with 20,000 ordinary shares of £10 each and 100,000 7 per cent. preference shares of £1 each. What rate of dividend will be paid on the ordinary shares at the end of the first year, if it is decided to distribute a total amount of £20,000 out of the net profits ?

15. How much would it cost to buy 500 £1 shares, the price of which is quoted at 15*s.* 9*d.* ?

16. Find the cost of 350 £1 shares which are quoted at $1\frac{1}{8}$.

17. A man buys 120 £1 shares in a company at the price of 16*s.* 3*d.* How much will he gain by his deal if he sells the shares later on when their price has risen to 22*s.* 6*d.* ?

18. What is the actual rate of interest (to the first decimal place) which is yielded by 6 per cent. preference shares quoted at 17*s.* 6*d.* ?

19. What is the yield of 8 per cent. preference shares quoted at 21*s.* 3*d.* (to first decimal place) ?

20. Find the rate of interest (to first decimal place) which is obtained by investing money in ordinary shares quoted at $2\frac{1}{4}$ which are expected to pay a dividend of 20 per cent.

CHAPTER XIV

HOW THE RATES ARE SPENT

71. The Municipal Budget.—We have already partly discussed the payment of rates in Chapter III. We must now inquire what the householder gets in return for the rates which he pays.

Whatever the locality may be called, there will be some kind of local council (either a Borough Council or a District Council) to govern and control it. We shall find out most of the duties and responsibilities of the *local governing body* by examining a typical *municipal budget* such as we usually find on the back of a rate demand note.

The municipal budget, like that of the family, shows how much money is to be received during a certain period, and how much it is expected will be spent during the same period. It differs, however, from the family budget in one important respect. The expenses of the family are regulated by the income. Frequently a man spends not what he wishes to spend or even what he needs to spend, but just what he can afford. If he cannot afford a particular thing, he has to go without it.

On the other hand, the local authority (through its Finance Committee) first decides what expenditure it considers necessary, and then takes steps to raise the money. In other words, the expenditure regulates the income.

The first example we will consider is taken from the rate demand note of an Urban District Council. It represents the expenditure for 6 months.*

Only the expenditure side of the budget is given (see Table XIII., p. 94).

It will be noticed that the total rate of 5*s.* in the £ is divided into two portions—a *Poor Rate* of 3*s.* in the £, and a *General District Rate* of 2*s.* in the £. These are usually both included on the rate demand note, though sometimes they are levied separately. In any case it is important for them to be given separately, especially in rural areas. This is because farmers are only called upon to pay a fraction of the full rate. Agricultural land pays half the Poor Rate, but only one-quarter of the General District Rate. This is reasonable, because the services which are covered by the General District Rate confer greater benefits in proportion to annual value on residential houses within the town than they do on farms and agricultural lands outside the town.

72. The Poor Rate.—The first item of expense covered by the *Poor Rate* is "*The relief of the poor* and other expenses of the Guardians," and we can add to this the fourth item on the list, the "expenses of the overseers." The actual work of relief of the poor is carried out by relieving officers, who are appointed by the Guardians, and the relief may consist of a grant of money,

* Municipal budgets are always prepared half-yearly. The rates, however, are sometimes collected quarterly, in which case the rates, as estimated for the half-year, are collected in two equal instalments.

as in the case of outdoor relief, or it may consist of maintenance and treatment in an institution, such as a workhouse, infirmary, or asylum. The cost of such relief, and all the expenses of the guardians, must be met out of the Poor Rate.

TABLE XIII.

HALF-YEARLY BUDGET OF AN URBAN DISTRICT.

Poor Rate 3s. in the £.	Relief of the poor, and other expenses of the Guardians	£ 6,153
	County contributions	13,110
	Police expenses	5,800
	Expenses of the overseers, salaries, etc.	260
		£25,323
General District Rate 2s. in the £.	Maintenance, improvement, and scavenging of public roads and streets	£ 1,050
	Sewerage and sewage disposal	1,050
	Removal of house refuse	1,220
	Disposal of house and street refuse	575
	Public lighting	2,000
	Pleasure grounds	660
	Fire Brigade and appliances	340
	Public baths	290
	Infant welfare	131
	Housing and town planning	352
	Contribution to Joint Hospital Board	900
	Notification and prevention of infectious disease	110
	Repayment of loans and interest	4,490
	Offices and buildings	128
	Establishment charges, including legal expenses and insurances	430
	Salaries of officers and assistants	1,653
	Contingencies	701
		£16,080

Another important item under the Poor Rate is that of *county contributions.* The County Council is responsible for a considerable expenditure, including the cost of education and the maintenance of main roads. The County Council does not actually levy rates, but sends a demand (or, as we call it, a *precept*) to each local authority within its area, asking it for its share of the expenditure. The local authority then includes the county expenditure in its own budget, as we have seen in the

above example, and the amount of the Poor Rate is determined accordingly.

The other item paid for out of the Poor Rate—viz., *police expenses*—does not require explanation.

73. The District Rate.—The expenses for which the *General District Rate* is levied give us some indications of the many duties of a local body. The Urban District Council is the *Sanitary authority*, and so it is responsible for cleansing the streets, maintaining sewers, disposing of sewage, and removing and disposing of house refuse. As the *Public Health authority* the Council maintains pleasure grounds, carries out housing and town-planning schemes, maintains public baths and washhouses, opens and supports Infant Welfare centres, takes steps for the notification and prevention of infectious diseases, and may either maintain a hospital or support one.

In addition, the Council is responsible for constructing, improving, widening, and maintaining public roads and streets. We have already said that main roads. such as run through many local areas, are the responsibility of the County Council. Arrangements may be made, however, whereby the local body takes over such main roads within its area and keeps them in repair, the County Council paying an agreed contribution towards the upkeep.

The District Council has also to see that the streets and roads within the town are well lighted.

The Council usually establishes and maintains a Fire Brigade at the public expense. If it wishes to do so, the Council may take over electric lighting or gas companies and tramways, but in such cases these undertakings would be expected to pay for themselves, and not to become a burden on the rates.

At this stage we shall omit any treatment of the item for the interest on, and repayment of, loans. This will be dealt with later in the chapter.

The only remaining items are for salaries, rent of offices and buildings, and establishment charges and contingencies.

The small item for contingencies is to provide a little money in hand in case, through some unforeseen occurrence, any of the estimates should prove to be insufficient, or any other payment should have to be made before the next half-year's rates fall due.

From the figures given in the half-yearly statement of expenditure given in Table XIII., we can make a number of useful calculations.

Example I.—The expenses covered by the Poor Rate amount to £25,323, and the Poor Rate was 3*s.* in the £. Assuming that

everybody paid at the full rate of 3*s.*, what would be the total rateable value of the district?

$$3s. \text{ in the £} = £25{,}323 \text{ for the whole district.}$$

$$\therefore 20s. \quad ,, \quad = \frac{20}{3} \times £25{,}323 = £168{,}820.$$

Example II.—Find (to the second decimal place) the rate in the £ for public lighting in the case considered in Table XIII.

Cost of public lighting = £2,000.
General District Rate of £16,080 = 2*s.* in the £.
£16,080 is equivalent to 24*d.* in the £.

$$\therefore £2{,}000 \quad ,, \quad ,, \quad \frac{24 \times 2{,}000d.}{16{,}080d.} = \frac{600d.}{201d.} = 2{\cdot}99d. \text{ in the £.}$$

Exercise 51.

Calculate, in the case considered in Table XIII., the rate in the £ (in pence to the second decimal place) which would have to be levied to meet the following items of expenditure:

1. Relief of the poor.
2. County contributions.
3. Police expenses.
4. Maintenance, improvement, and scavenging of roads and streets.
5. Removal of house refuse.
6. Disposal of house and street refuse.
7. Pleasure grounds.
8. Contribution to Joint Hospital Board.
9. Repayment of loans and interest.
10. Salaries of officers and assistants.
11. Infant welfare.
12. Fire Brigade and appliances.
13. Housing and town planning.
14. Offices and buildings.

Exercise 52.

Find the rateable values of boroughs in which:

1.	A rate of	5*s.*	in the £ yields	£14,524.
2.	,, ,,	4*s.*	,, ,, ,,	£23,457.
3.	,, ,,	7*s.*	,, ,, ,,	£43,554.
4.	,, ,,	6*s.*	,, ,, ,,	£13,950.
5.	,, ,,	4*s.* 6*d.*	,, ,, ,,	£27,468.
6.	,, ,,	7*s.* 6*d.*	,, ,, ,,	£17,310.
7.	,, ,,	8*s.* 3*d.*	,, ,, ,,	£23,430
8.	,, ,,	9*s.* 6*d.*	,, ,, ,,	£21,014.
9.	,, ,,	7*s.* 3*d.*	,, ,, ,,	£15,428.
10.	,, ,,	5*s.* 6*d.*	,, ,, ,,	£7,601.

Example.—What reduction in the rates in the £ would you expect in the case of a borough with a rateable value of £723,427, for which the estimated expenditure for the coming half-year is £17,825 less than it was for the half-year just ended ? (Answer to nearest penny.)

$$\text{Reduction in rates} = £\frac{17,825}{723,427}.$$

We shall work this out by means of decimals, using the contracted method of Chapter IX. The answer is required correct to 5 places of decimals, so we must work it out to 6 places.

Estimated answer $= £\frac{1\cdot7}{70} = £\cdot02\ .\ .\ .$, so there will be 5 significant figures in the answer. We must retain 6 digits in our divisor:

```
72,3,4,2,7 ) 1782500 ( £·024639
             1446854
             -------
              335646
              289371
              ------
               46275
               43405
               -----
                2870
                2170
                ----
                 700
```

Reduction in rates $= £\cdot02464$
$= 6d.$ in the £ (to nearest penny.)

Exercise 53.

What reduction in the rates in the £ (to the nearest penny) would be possible in the case of the following boroughs for a half-year in which the estimated expenditure is less by the amount shown than it was for the half-year just ended ?

	Rateable Value.	*Reduction in Expenditure.*
	£	£
1.	423,573	11,273
2.	1,473,263	22,399
3.	566,230	10,211
4.	274,320	8,342
5.	951,416	11,923
6.	2,834,270	48,321
7.	5,373,421	134,753
8.	876,427	36,279
9.	434,575	7,320
10.	563,299	6,281

TABLE XIV.—RATE DEMAND NOTE OF A LONDON BOROUGH.

Purposes.	*Sum required.*	*Amount in £.*		*Purposes.*	*Sum required.*		*Amount in £.*	
	£	s.	d.		£	£	s. d.	s. d.
Expenses of Borough Council:				Expenses of other Authorities:				
Removing house refuse and cleansing streets ..	50,913		11·97	Guardians (including contributions to Asylums Board and Common Poor Fund)		118,419		2 3·85
Maintaining streets ..	31,778		7·48					
Lighting	8,628		2·03					
Sewerage	7,248		1·70					
Baths and wash-houses ..	13,357		3·14					
Cemeteries	2,294		·54					
Libraries	3,713		·87	London County Council:				
Food and Drugs Acts ..	697		·17	General County purposes	45,798		10·77	
Other Public Health Expenses	15,133		3·56	Special County purposes	6,467		1·52	
				Education:				
Housing of the Working Classes	1,095		·26	Elementary	63,037		1 2·83	
Museum and gymnasium ..	603		·14	Higher	16,701		3·93	
Cost of collection	3,038		(·71)			132,003		2 7·05
Other expenses	36,015		8·47					
	174,512	3	4·33	Metropolitan Police ..		31,334		7·37
Less estimated Grant from Equalization Fund ..	10,392		2·45	Metropolitan Water Board		16,364		3·85
Expenditure over which the Borough Council has control .. ..£	164,120	3	1·88	Expenditure over which the Borough Council has no control .. ..£		298,120		5 10·12

Total .. .. .. £462,240 = 9*s.* in the £.

It is estimated that a sum of £10,392 will be received by the Borough Council from the London County Council, out of the Equalization Fund authorized by the Act of 1894. The amount of the Rate hereby demanded is consequently less to the extent of 2·45*d.* in the £ than it otherwise would have been.

74. Rates in a London Borough.—We will take one further example of a Rate demand note, in this case the rate being one levied by a London Borough Council. This is given in Table XIV.

In this example the rate in the £ for each item of expenditure is calculated already in pence to the second decimal place. The portion of the county expenses (those of the London County Council) due to education are also shown. There is also an item for the Metropolitan Water Board. In addition to this charge, houses in the London area have to pay a Water Rate direct to the Metropolitan Water Board.

Something must be said about the footnote to the rate demand note in Table XIV. This refers to a sum of £10,392 received by the Borough Council out of the *Equalization Fund*. This needs some explanation.

75. The Equalization Fund.—London is so big that it is divided for local purposes into the City of London, the City of Westminster, and other areas called metropolitan boroughs. One effect of this is that some of the boroughs contain large dwelling houses and business houses of great value, while other boroughs include very poor districts with property of low value. The result is that two boroughs of the same size and with approximately the same expenses may find the rateable value of their property differ to such an extent that the rates in one borough may be only half those in the other. The borough with the poorer property, which is consequently less able to bear high rates, will actually be the one in which the rates will be higher. An example may make this plain. If in each case the expenses were £500,000 per year, and in one case the total rateable value were £1,000,000 and in the other it were £500,000, then in the former case the rates would be 10*s*. in the £, and in the latter case they would be 20*s*. in the £. If we consider two similar houses, rated at £40, one in each borough, then in the former case the rates paid per year would be £20, and in the latter case they would be £40. Under the London (Equalization of Rates) Act, 1894, an attempt was made to lessen the burden of the poorer boroughs. Contributions based on the total rateable value of each borough are made to an Equalization Fund, and from this fund the poorer boroughs receive grants.

76. The Metropolitan Common Poor Fund.—A similar relief is obtained through the administration of the Metropolitan Common Poor Fund. Contributions are made by all the metropolitan boroughs, according to their rateable value, and payments from

the fund are made according to requirements. Thus the rich boroughs make the largest contributions, while the poor boroughs reap the largest benefits.

Example I.—What per cent. (to the first decimal place) of the total rate of 9*s*. in the £ shown in Table XIV. is due to the cost of maintaining the streets ?

Total expenditure = £462,240

Cost of maintaining streets = £31,778

$$\text{Percentage of total expenditure} = \frac{31{,}778 \times 100}{462{,}240}$$

$$= \frac{3{,}177{,}800}{462{,}240}$$

$$= 6{\cdot}9 \text{ per cent.}$$

Example II.—If a man lives in a house rated at £29 per year, how much does he pay in the half-year for Elementary and Higher Education at the rate shown in Table XIV. (to nearest penny)?

Rate for Elementary Education	= 1*s*. 2·83*d*.
,, Higher ,,	= 3·93*d*.
Total Education Rate	= 1*s*. 6·76*d*.
∴ Rate per half-year on a house rated at £29	= 1*s*. 6·76*d*. × 29
	= 29*s*. + 14*s*. 6*d*. + 1*s*. 10·04*d*.
	= £2 5*s*. 4*d*. (to nearest penny).

Exercise 54.

In the following Examples the Rates are to be taken as shown in Table XIV.

Find (to the first decimal place) the percentage of the total rate which is due to the cost of the following services:

1. Removing house refuse and cleansing streets.
2. Lighting.
3. Sewerage.
4. Baths and washhouses.
5. Libraries.
6. Housing of the working classes.
7. Cost of collection.
8. Guardians.
9. Elementary education.
10. Metropolitan police.

If a man lives in a house rated at £26 per year, find (to the nearest penny) how much he has to pay per half-year for the following services:

11. Maintaining streets.
12. Lighting.
13. Sewerage.
14. Libraries.
15. Baths and washhouses.
16. Guardians.
17. General county purposes.
18. Metropolitan police.

77. Other Sources of Income of a Local Authority.—We must now consider briefly the other sources of income of a local authority. These are (1) grants in aid; (2) receipts from municipal undertakings, or rent of land or houses owned by the municipality; (3) loans.

"*Grants in aid*" are sums of money paid by a Government department to the local authority for a definite purpose.* The most important is the grant made towards the cost of education, though other grants may also be made, for such purposes as the construction and maintenance of roads, the building of houses and the maintenance of public health by the establishment of welfare centres, sanatoria, etc.

The *receipts from municipal undertakings* need not trouble us much. Most undertakings of this kind are in the nature of public services. Some local authorities own electrical power stations, some run tramway services, some own gasworks or waterworks. In nearly every case the service is one which affects practically the whole community, and so, as a general rule, the local authority tries to give the inhabitants the benefit of its administration either by a cheaper or a better service, and does not aim at making great profits. Consequently, against revenue of this kind we have to set expenditure of practically an equal amount, and possibly even of a greater amount.

Rent, when it exists at all, is generally a small item. It rarely arises except in connection with small-holdings, or housing schemes, and here again there will generally be expenses to be set against the revenue.

78. Municipal Loans.—Something must also be said about Municipal Loans, which are important because of their bearing upon future expenditure. Under certain circumstances a local authority may raise money by loans for special purposes of a capital nature, such as housing, building of harbours, bridges,

* The money paid as "grants in aid" is raised by means of the National Budget and is included in the item "Civil Services" (see paragraph 82 on p. 108).

schools, and public buildings, etc. Permission to raise the loan has to be obtained either from the County Council or the Ministry of Health, or both, and this permission is given only on condition that so much money is set aside each year to pay the interest on the loan and also to provide a *sinking fund* for the repayment of the loan after a definite number of years. This is usually done by arranging for a fixed sum to be paid each year, part to be used in payment of interest and the remainder either in repaying the loan or in building up the sinking fund out of which the loan will ultimately be paid.

Special tables have been worked out showing the annual amount required to provide principal and interest, so that a loan can be repaid in a stated number of years. The following table gives the sum needed annually to provide both principal and interest in order to liquidate a debt of £100 at the stated percentage in 10, 20, 30, 40, or 50 years:

TABLE XV.

ANNUAL PAYMENTS NEEDED TO LIQUIDATE A DEBT.

No. of Years.	*3 per Cent.*	*3½ per Cent.*	*4 per Cent.*	*4½ per Cent.*	*5 per Cent.*
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
10	11 14 5½	12 0 5¾	12 6 7	12 12 9	12 19 0
20	6 14 5¼	7 0 8¾	7 7 2	7 13 9	8 0 5¾
30	5 2 0½	5 8 9	5 15 8	6 2 9½	6 10 1¼
40	4 6 6¼	4 13 7¾	5 1 0½	5 9 8¼	5 16 6¾
50	3 17 8¼	4 5 3¼	4 13 1¼	5 1 2½	5 9 6¾

If the loan be for £2,000, then the annual instalments shown above should be multiplied by 20, and so on.

Example.—A local authority borrows £50,000 at 4½ per cent., and wishes to repay the loan in 40 years. What annual payment will be required both to do this and pay the interest on the loan ?

Annual payment required for loan of £100 = £5 9*s.* 8¼*d.*
∴ „ „ „ „ £50,000 = 500 × £5 9*s.* 8¼*d.*
= £2,742 3*s.* 9*d.*

Exercise 55.

Using Table XIV., find the annual payments necessary to repay the following municipal loans:

1.	£10,000	borrowed	for	20	years at	4	per cent.	interest.
2.	£15,000	,,	,,	30	,,	$3\frac{1}{2}$	,,	,,
3.	£25,000	,,	,,	40	,,	5	,,	,,
4.	£5,000	,,	,,	10	,,	$4\frac{1}{2}$	,,	,,
5.	£17,000	,,	,,	50	,,	4	,,	,,
6.	£50,000	,,	,,	50	,,	$3\frac{1}{2}$	,,	,,
7.	£30,000	,,	,,	20	,,	4	,,	,,
8.	£35,000	,,	,,	30	,,	$4\frac{1}{2}$	,,	,,
9.	£45,000	,,	,,	40	,,	4	,,	,,
10.	£42,000	,,	,,	20	,,	5	,,	,,

Exercise 56.

Miscellaneous Examples on Chapter XIV.

1. What is the rateable value of a borough in which a rate of 1*d.* in the £ yields £2,512 ?

2. What is the rateable value of a borough in which a rate of 1*s.* in the £ yields £1,250 ?

3. What is the rateable value of a borough in which a rate of 8*s.* 7*d.* in the £ yields £77,456 ?

4. The estimated expenditure of a borough for the coming half-year is £47,523. It is proposed to raise this amount by a rate of 7*s.* 9*d.* in the £. What is the rateable value of the borough ?

5. How much would be raised by a rate of 5*s.* 6*d.* in the £ in a borough the assessable value of which is £212,520 ?

6. What would be produced by a penny rate in a borough rated at £550,000 ?

7. A borough is rated at £625,000, and the cost of maintaining the police is £20,723. What rate in the £ is this equivalent to, to the nearest penny ?

8. A borough rated at £172,500 wishes to spend £2,700 on the roads during a certain half-year. What rate must be levied to meet this expense ? (Give answer to the nearest tenth of a penny.)

9. A London borough, rated at £454,000, receives £8,247 from the Equalization Fund in relief of its rates. Find the amount in the £ (to nearest tenth of a penny) by which this sum will reduce the rates.

10. If the education rate in a borough is 1*s.* 5·72*d.* in the £ for the half-year, find (to the nearest penny) the amount paid for education per annum by a man living in a house rated at £45.

11. If the rate for maintaining the streets in a borough is 7·27*d.* in the £ for the half-year, find (to the nearest penny) the amount paid for this purpose by a business man whose factory is rated at £2,500.

12. Using Table XV., find the annual payment which a local authority must make in order to repay a debt of £35,000 borrowed for 40 years at 4 per cent. interest.

CHAPTER XV

THE NATIONAL BUDGET

79. Budget for 1929-30.—The national expenditure is always considered for the year ending March 31. Accordingly, in April of every year the Chancellor of the Exchequer introduces to the House of Commons the *National Budget* for the year just begun. This Budget is more complicated than a municipal budget, because there are many more sources of income as well as a great many more directions of expenditure. The National Budget for any year is an estimate of the expenditure for the year to come and a statement of the taxes which are necessary to meet it. If the expenditure is expected to increase, new taxes will have to be imposed or old taxes will be increased. These changes in taxation are introduced with the Budget.

The Budget for 1929-30 (*i.e.*, from April 1, 1929, to March 31, 1930) was introduced in the House of Commons on April 15, 1929, and Table XVI. gives a summary of its estimated Income and Expenditure.

80. Consolidated Fund Services.—We will first consider the expenditure side. This really consists of two parts. The first six items consist of expenditure on what are called the *Consolidated Fund Services.* The Consolidated Fund Services at the present time are those which are provided for by permanent Acts of Parliament. These items of expenditure cannot be questioned by the House of Commons when the Budget is presented, because they have already been sanctioned by Acts of Parliament which are permanently in force.

81. National Debt Services.—This is the first of the Consolidated Fund Services. The National Debt has for a long time been, in many respects, the most important item in the national accounts.

We must not imagine that, because we are dealing with the National Budget instead of the family budget, the ordinary principles regarding payment of expenses out of income no longer hold. It is obvious, in dealing with the family budget, that if we spend more than our income we shall soon become bankrupt. It is no less true that a nation which regularly spends more than it receives will speedily become bankrupt.

In the case of extraordinary expenditure, however, such as that which a country has to face in time of war, it may not be possible to pay the whole cost out of income. It is justifiable in such a

case to borrow the money at as low a rate of interest as possible, and with a view to repaying the loan at the earliest possible date.

TABLE XVI.

Summary of National Budget (1929-30).*

Estimated Revenue.	£	*Estimated Expenditure.*	£
Customs	119,850,000	National Debt Services	355,000,000
Excise	130,330,000	Payment to Local Taxation Accounts ..	15,000,000
Motor Tax (Less Road Fund) ..	4,680,000	Payments for N. Ireland ..	5,400,000
Estate Duties ..	81,000,000	Other Consolidated Fund Services	3,500,000
Stamps	31,000,000	Navy	55,865,000
Land Tax, etc. ..	800,000	Army	40,545,000
Income Tax ..	239,500,000	Air Force ..	16,200,000
Super-Tax ..	58,000,000	Civil Services ..	223,325,000
Excess Profits Duty, and Corporation Profits Tax	1,700,000	Customs, Excise, and Inland Revenue	11,569,000
Post Office (Net Receipts) ..	8,900,000	Rating Relief ..	15,560,000
Crown Lands ..	1,250,000		
Interest on Sundry Loans ..	30,550,000	Total ..	741,964,000
Miscellaneous Ordinary Receipts	12,500,000	Surplus ..	4,096,000
Special Receipts ..	26,000,000		
Total ..	£746,060,000	Total ..	£746,060,000

It must always be remembered that interest has to be paid on all money so borrowed. Thus, by borrowing money now, we increase the financial burden upon the country in years to come.

A country which continued to borrow money in order to meet the ordinary expenses of each year would, therefore, be making its financial position grow worse and worse, and would indeed be as surely on the road to bankruptcy as a man who lived on borrowed money.

* The above summary includes merely the net receipts from the Post Office (after all outgoings have been met), and the net yield of the Motor Tax, after providing £22,500,000 for the Road Fund.

Practically the whole of our National Debt represents the cost to the country of the various wars we have waged. The wars against France, between 1793 and 1815, cost us 600 million pounds, and the South African war cost us about 140 million pounds. The National Debt in 1914 amounted to 651 million pounds, and in 1920, after the Great War, it had reached the huge figure of 7,832 million pounds, though this latter figure should be reduced by the money lent by us to Allied and Dominion Governments, which together totalled 1,844 million pounds.

Table XVII. shows the amount of the National Debt and the annual cost to the country for interest and management for various years. Amounts are given to the nearest million pounds.

TABLE XVII.

National Debt of the United Kingdom.

Year.	*Total Amount of Debt.*	*Cost of Interest and Management.*
	£	£
1914	651,000,000	23,000,000
1915	1,109,000,000	60,000,000
1916	2,141,000,000	127,000,000
1917	4,011,000,000	190,000,000
1918	5,872,000,000	270,000.000
1919	7,435,000,000	332,000,000
1920	7,832,000,000	345,000,000
1925	7,646,394,000	355,000,000
1929	7,501,000,000	355,000,000

It is difficult to realize what these huge figures mean. We can arrive at some idea, however, by representing the debt as so much per head of our population, as is done in the following example.

Example I.—Taking the population of the United Kingdom as 45,000,000, how much was the National Debt per head (to the nearest pound) in 1920 ?

$$\text{National Debt per head of population} = \frac{7,832}{45} = £174.$$

Example II.—Taking an average family as consisting of five persons, find how much had to be paid, on an average, by every family in 1920 to meet the cost of the National Debt.

$$\text{Number of families} = \frac{45{,}000{,}000}{5} = 9{,}000{,}000.$$

$$\therefore \text{ Cost of interest, etc., per family} = £\frac{345}{9} = £38{\cdot}333$$
$$= £38 \ 7s. \text{ (to nearest shilling.)}$$

Exercise 57.

Use Table XVII. for all particulars required in the Examples 1 *to* 4.

1. Taking the population of the United Kingdom as 45,000,000, find (to the nearest pound) the National Debt per head in the following years: (*a*) 1914; (*b*) 1915; (*c*) 1916; (*d*) 1917; (*e*) 1918; (*f*) 1919; (*g*) 1925.

2. Taking an average family as consisting of 5 persons, find how much had to be paid, on an average, per family in the United Kingdom to meet the interest and expenses of the National Debt in the following years: (*a*) 1914; (*b*) 1915; (*c*) 1916; (*d*) 1917; (*e*) 1918; (*f*) 1919. Give answers to nearest shilling.

3. Find (to the first place of decimals) the rate of interest (including expenses of management) on the National Debt for the following years: (*a*) 1914; (*b*) 1915; (*c*) 1916; (*d*) 1917; (*e*) 1918; (*f*) 1919; (*g*) 1925.

4. What was the increase in the National Debt during the following years: (*a*) 1914-15; (*b*) 1915-16; (*c*) 1916-17; (*d*) 1917-18; (*e*) 1918-19; (*f*) 1919-20 ?

5. Using Table XVI., find (to the nearest shilling) the national expenditure per average family on (*a*) the Navy; (*b*) the Army; (*c*) the Air Force; (*d*) the Civil Services.

6. Using Table XVI., find (to the nearest shilling) the national income per average family from (*a*) Customs; (*b*) Excise; (*c*) Motor Tax; (*d*) Estate Duties; (*e*) Income Tax; (*f*) Super-Tax.

82. The Civil Services.—There are two other items of expenditure to which we must give special attention—the Civil Services and the Post Office Services. The expenses of the Navy, Army, and Air Force need no explanation, and the expenditure on the Customs, Excise, and Inland Revenue is accounted for mainly by the cost of collecting the greater part of the national income.

The most interesting items of expenditure included in the term "Civil Services" are given in the table on p. 108. Each of these represents the cost of running one or more of the departments responsible for the government of the country.

The greater portion of the grant to the Ministry of Pensions is on account of the pensions paid as a result of the Great War. This is an item that will gradually be reduced year by year by the deaths of those entitled to pensions. The grants to the Ministries of Health and Labour include the amounts granted by the Government towards National Health and Unemployment Insurance. The greater part of the money granted to the Board of

Education will be paid to the various education authorities "grants-in-aid" towards the cost of running schools and college

TABLE XVIII.

EXPENDITURE ON CIVIL SERVICES (1929-30).

	£
Central Government and Finance	2,163,00
Imperial and Foreign	5,144,00
Law and Justice	12,407,00
Education	50,004,00
Health, Labour, and Insurance (including Old Age and Widows' Pensions)	79,056,00
War Pensions and Civil Pensions	56,332,00
Other Services	18,219,000
	£223,325,000

EXERCISE 58.

Making use of Table XVIII., find (to the nearest shilling) the cost of the following expenditure of the Civil Service per average family of 5 persons during the year 1929-30:

1. Law and Justice.
2. Health, Labour, and Insurance.
3. War Pensions and Civil Pensions.
4. Education.
5. Central Government and Finance.
6. In 1918-19, the total income from National Health Insurance was 30½ million pounds, of which the Government contributed 8½ million pounds. The number of insured persons was 15½ millions, and the total expenditure was 20½ million pounds. (*a*) Find the total income (to the nearest shilling) per head of the whole population. (*b*) Find (to the nearest penny) the balance in hand, per insured person, after paying expenses. (*c*) Find (to the nearest penny) what the Government contribution amounted to per average family of 5 persons.
7. It is estimated that if Old Age Pensions in full were paid to all over the age of 70, irrespective of means, it would cost 41 million pounds. If they were granted at the age of 65, the estimated cost is 70 million pounds. Find the cost per head of population per year (to the nearest shilling) of granting universal Old Age Pensions (*a*) at the age of 70; (*b*) at the age of 65.

83. The Post Office Services.—It will be seen from Table XVI. that an item for the Post Office appears, being the surplus of receipts over expenditure. In the following statement details are given of the income and expenditure during the year ended March 31, 1928. The Post Office is really a business conducted by the nation, and an examination of its accounts gives us an insight into the various directions in which any business concern spends its money.

TABLE XIX.

Post Office Account (1927-28).

Income.	£	*Expenditure.*	£
Postal business ..	38,253,024	Salaries, wages, etc.	32,554,519
Telegraph business	4,795,968	Rent, rates, office fittings, etc. ..	2,915,797
Telephone business	18,675,490	Conveyance of mails	5,675,314
Postal Order and Money Order business ..	1,189,178	Telegraph and telephone systems	3,345,056
Other Services ..	3,900,666	Pension liability ..	3,393,199
		Depreciation on plant	5,219,710
		Interest on capital	4,454,917
		Miscellaneous charges	1,685,466
			£59,243,978
		Profit on working	7,570,348
	£66,814,326		£66,814,326

Exercise 59.

Table XIX. is to be used in answering the following Examples.

1. Express as a percentage of the total Post Office income (correct to the first decimal place) the following separate items of expenditure: (*a*) Salaries, wages, etc.; (*b*) rent, rates, etc.; (*c*) conveyance of mails; (*d*) telegraph and telephone systems; (*e*) interest on capital; (*f*) pension liability.

2. The total sum due to depositors in the Post Office Savings Bank in 1925 was £266,508,000. The number of depositors was roughly 13,383,000. (*a*) Find (to the nearest shilling) the average amount due to each depositor. (*b*) What percentage of the amount deposited was the expenditure of £1,172,110? (Answer to second decimal place.)

84. Customs.—We have next to consider the various sources of income shown in the Budget. The first of these is the "*Customs duties*"—that is to say, the duties which are charged upon certain classes of goods imported into the country. There are too

many of these to allow us to give the Customs tariff in full, but the following is a selected list of well-known articles which were subject to a Customs duty upon coming into the United Kingdom during the year 1929-30:

	£	s.	d.
Chicory: roasted or ground, per lb. ..	0	0	2
Cocoa, per cwt. ..	0	14	0
Coffee: roasted or ground, per lb. ..	0	0	2
Currants, per cwt. ..	0	2	0
Figs and prunes, per cwt.	0	7	0
Matches: Per gross of boxes, each containing 20 to 50 matches	0	4	4
Sugar, per cwt., from	0	4	6
to	0	11	8
Marmalade and jams, per cwt.	0	8	5
Tobacco, cigars, per lb.	0	15	7
Tobacco, manufactured, per lb. ..	0	11	$10\frac{1}{2}$
Tobacco, cigarettes, per lb.	0	12	7
Clocks, watches, motor-cars, musical instruments: an amount equal to $33\frac{1}{3}$ per cent. of the value of the article.			

Example.—Cocoa is sold at 1*s.* 6*d.* per lb. What percentage of this is Customs duty ?

Customs duty on cocoa = 14*s.* per cwt.
Selling price of 1 cwt. cocoa = 1*s.* 6*d.* × 112 = 168*s.*
∴ Duty on 168*s.* = 14*s.*

$$\text{,, ,, } 100s. = \frac{14 \times 100}{168} = 8{\cdot}3 \text{ per cent.}$$

Exercise 60.

Make use of the Customs Tariff given above in answering these Examples.

1. A man smokes 50 cigarettes per week. If 25 cigarettes weigh 1 ounce, what does the man pay in Customs duty on the cigarettes which he smokes in the course of a year ?

2. A man smokes 4 ounces of tobacco per week. How much Customs duty does he pay on the tobacco which he smokes in a year ?

3. Imported cigarettes are 1*s.* 2*d.* per ounce. What percentage of this is Customs duty ? (Give answer to first decimal place.)

4. Currants are sold at 6*d.* per lb. What percentage of this is Customs duty ? (Give answer to first decimal place.)

5. Coffee is sold at 2*s.* 6*d.* per lb. What percentage of this is Customs duty ?

6. Find the Customs duty on 1 lb. cocoa.

7. Find the Customs duty on 1 lb. figs.

8. Find (to the nearest farthing) the duty on 1 dozen boxes matches, each containing 50 matches.

9. Find (to the nearest farthing) the duty on 1 lb. sugar at 11*s.* 8*d.* duty per cwt.

10. Find (to the nearest farthing) the duty on 1 lb. imported jam.

11. Using the results of Questions 6 to 10, find what Customs duty would be paid in a week by a family which buys ½ lb. cocoa, 1 dozen matches (50 in a box), 4 lbs. sugar, 1 lb. imported jam.

10. What Customs duty will be paid in a week by a family which buys each week, on an average, 6 lbs. sugar, ½ lb. coffee, 2 lbs. imported jam, 1 dozen matches (50 in a box), and 2 ounces tobacco ?

The following were the main receipts from Customs duties for the year 1927-28:

	£		£
Tea	5,780,978	Wine	4,148,560
Cocoa and coffee ..	901,043	Spirits	6,799,049
Sugar	17,039,117	Matches	2,209,262
Tobacco and snuff	58,102,242	Silk and artificial silk	4,767,408

85. **Excise Duties and Licences.**—The item "Excise" on the income side of the National Budget covers the income from duties levied by the "Board of Customs and Excise" upon:

(*a*) The right to carry on certain businesses, for which licences are issued; and

(*b*) The manufacture within the country of certain articles.

Some of the best-known examples of (*b*) are as follows:

	£	*s.*	*d.*
Beer: for every 36 galls.	4	0	0
Patent medicines:			
Value not over 1*s.*	0	0	3
,, ,, ,, 2*s.* 6*d.*	0	0	6
,, ,, ,, 4*s.*	0	1	0
Spirits, per proof gall.	3	12	6

The following are among the businesses which have to pay for a licence to permit them to be carried on:

	£	*s.*	*d.*
Auctioneer	10	0	0
House agent	2	0	0
Pawnbroker	7	10	0

There is also included in the Excise duties the Entertainments Tax, charged on payments for admission to any place of entertainment.

The following were the main receipts from Excise duties for the year 1927-28:

	£
Duty on beer	77,800,471
,, ,, spirits	40,568,523
,, ,, patent medicines	1,249,445
Licenses	5,078,167
Entertainments	6,119,978
Matches, etc.	1,744,489

Exercise 61.

In answering the following Examples, make use of the data given in paragraph 85.

1. Find (to the nearest penny) the Excise duty charged upon every pint of beer brewed.

2. Find (to the nearest penny) the Excise duty upon each bottle of spirits manufactured, taking 8 bottles to the gallon.

3. A bottle of patent medicine is sold for 1*s.* 1½*d.*, including the stamp duty. What percentage of this price is Excise duty ?

4. What is the average Excise duty paid (to the nearest shilling) per annum per average family of 5, on (*a*) beer; (*b*) spirits; (*c*) patent medicines; (*d*) entertainments ? (Assume that there are 9,000,000 families in the United Kingdom.)

86. Estate Duties.—Passing over the Motor Tax, a special tax, counterbalanced by the cost of putting the roads of the country into a satisfactory condition, we come to the *Estate duties.* The sum of £81,000,000 was expected to be derived from this source during the year 1929-30. It is interesting to note that the national income from this source has increased in recent years. For 1925-26 it was £66,500,000.

When a man dies he usually has a certain amount of property, which may include land, houses, stocks and shares, and actual money. If he is poor the amount may only be small—perhaps a few pounds. If he is rich the total value of his property may be great. If the total value is greater than £100, a tax upon it has to be paid to the State. This tax is expressed as a percentage of the total value of the estate, and the percentage increases very rapidly as the value of the estate rises. The following table gives the amount of the duty for estates of various values:

TABLE XX.

ESTATE DUTIES.*

Value of Property Exceeds.	*Estate Duty Per Cent.*	*Value of Property Exceeds.*	*Estate Duty Per Cent.*
£		£	
100	1	75,000	18
500	2	85,000	19
1,000	3	100,000	20
5,000	4	120,000	21
10,000	5	140,000	22
12,500	6	170,000	23
15,000	7	200,000	24
18,000	8	250,000	25
21,000	9	325,000	26
25,000	10	400,000	27
30,000	11	500,000	28
35,000	12	750,000	29
40,000	13	1,000,000	30
45,000	14	1,250,000	32
50,000	15	1,500,000	35
55,000	16	2,000,000	40
65,000	17		

Example I.—What Estate duty would be payable on an estate valued at £1,219,908 ?

This estate lies between £1,000,000 and £1,250,000.

∴ The duty is 30 per cent.=£1,219,908 × ·3
=£365,972·4=£365,972 8*s*.

Example II.—Find what would remain of an estate valued at £288,500 after paying Death duties.

Value of estate	=	£288,500
(This lies between £250,000 and £325,000.)		
∴ Duty is 25 per cent.=£288,500 × ·25	=	72,125
Residue of estate	=	£216,375

* The Estate duties are not the only tax made upon a man's estate when he dies. There are also *Legacy duties*, to be paid by everyone who benefits by his will. The Estate duties are the more important, however, and it is only these which are to be taken into account in the examples given.

Exercise 62.

Use Table XX. in answering the following Examples.

What estate duties would be paid on the following estates ?

1. £1,122,020	2. £381,410	3. £150,400
4. £75,240	5. £6,530	6. £720

Find the residue of the following estates after paying Death duties:

7. £1,620,300	8. £752,400	9. £318,750
10. £162,300	11. £15,400	12. £1,150

87. Stamp Duty.—The item of £31,000,000 from "*stamps*" in the estimated revenue is for taxes which have to be paid on receipts and agreements of various kinds. The receipts for such taxes take the form of stamps affixed to the agreements or impressed upon them. Thus a 2*d.* postage stamp has to be affixed to every receipt for an amount of £2 or over; and every cheque issued by a Bank bears a 2*d.* stamp embossed upon it. When a Limited Liability Company is formed, Stamp duty is paid amounting to 1 per cent. of the capital. Insurance policies and agreements for taking over the tenancy of a house also have to be stamped. These are a few examples showing how revenue is obtained by means of Stamp duties.

88. Sur-Tax.—The biggest item on the revenue side of the Budget is for Income Tax, but Sur-Tax (which has taken the place of what used to be called Super-Tax) is also an important item. The receipts during the year 1927-28 were as follows:

Income Tax = £250,583,000.
Super-Tax = £60,600,000.

We have already dealt with Income Tax, and *Sur-Tax* is an *additional* tax of the same kind upon incomes which exceed £2,000. The rate at which the Sur-Tax is charged is so much in the £, just as it was in the case of Income Tax. The rates at which Sur-Tax is charged are given in Table XXI.

Example.—What Sur-Tax will be paid by a man whose total income is £5,900 ?

Income.		*Sur-Tax.*		£	*s.*	*d.*
First £2,000	=	Nil	=		—	
Next £500 at 9*d.*	=	500 × 9*d.*	=	18	15	0
,, £500 at 1*s.*	=	500 × 1*s.*	=	25	0	0
,, £1,000 at 1*s.* 6*d.*	=	1,000 × 1*s.* 6*d.*	=	75	0	0
,, £1,000 at 2*s.* 3*d.*	=	1,000 × 2*s.* 3*d.*	=	112	10	0
,, £900 at 3*s.*	=	900 × 3*s.*	=	135	0	0
Income = £5,900		Sur-Tax	=	£366	5	0

TABLE XXI.

Sur-Tax.

Income.	*Sur-Tax in the £.*
In respect of the first £2,000	Nil
In respect of the excess over £2,000:	*s.* *d.*
For every £ of the first £500	0 9
" " " next £500	1 0
" " " " £1,000	1 6
" " " " £1,000	2 3
" " " " £1,000	3 0
" " " " £2,000	3 6
" " " " £2,000	4 0
" " " " £5,000	4 6
" " " " £5,000	5 0
" " " " £10,000	5 6
" " " remainder	6 0

Exercise 63.

Use Table XXI. in calculating the Sur-Tax in the following Examples.

What Sur-Tax will be paid by men whose incomes are as follows ?

1. £2,600	**2.** £3,320	**3.** £4,530
4. £5,660	**5.** £8,420	**6.** £3.900
7. £4,500	**8.** £21,000	**9.** £55,000
10. £100,000	**11.** £110,000	**12.** £122,200

89. Other Sources of Revenue.—We can dismiss the other sources of revenue briefly:

(*a*) *The Corporation Profits Duty* was a tax levied on the profits of every Limited Liability Company. This tax was introduced in 1920 and abolished in 1924. The revenue shown represents arrears of tax.

(*b*) *The Excess Profits Duty* was a duty upon the profits made by any business in excess of their pre-war profits. This is no longer in operation, so the amount included in the Budget represents *arrears* of the duty.

(*c*) *Land Tax and House Duty.*—The Land Tax is a relic of a tax fixed about 1690, and is not very important, as in most cases it has been redeemed by the payment of a lump sum. The House Duty is no longer imposed. It was a yearly tax payable on inhabited houses of an annual value of not less than £20, and it was abolished in 1924. The amount which figures in the Budget will be for arrears, and the sum will be small. Except in the few cases where Land Tax is still levied, the only tax now payable on the annual value of houses is the Income Tax, sometimes called the Landlord's Property Tax, and this is subject to the ordinary rules of Income Tax given in Chapter XII. The tax is payable on January 1 each year. When rent is paid quarterly, the income tax is paid by the tenant, and the amount deducted from the next payment of rent. If the landlord's income is such that either he is totally exempt from tax or his income is only taxable at the half-rate of 2*s.* in the £, he can claim a repayment of any amount which has been overpaid.

The amount on which tax is chargeable is arrived at by deducting an allowance for repairs from the gross annual value (*i.e.*, the yearly rent received by the landlord). For houses and buildings this allowance is as follows:

Annual value not exceeding £40	$\frac{1}{4}$ of annual value.
£40 to £50	£10.
Over £50, but not exceeding £100 ..	$\frac{1}{5}$ of annual value.
Over £100	£20 plus $\frac{1}{6}$ of the amount over £100.

The Income Tax thus charged upon the annual value of the house includes the tax upon the annual value of the ground the house is built on. If, therefore, the landlord pays ground rent to a ground landlord, he can deduct from the ground rent Income Tax at the rate of 4*s.* in the £ (which the tenant has already deducted from the rent paid to *him*), thus passing the tax on to the ground landlord.

Example.—What amount will a landlord of a house actually pay to a ground landlord after deducting Income Tax, if the ground rent is £7 7*s.* per year ?

	£	*s.*	*d.*
Ground rent =	7	7	0
Income Tax at 4*s.* in the £ =	1	9	5
Amount paid to ground landlord =	£5	17	7

Exercise 64.

Find the Income Tax payable annually upon houses of the gross annual values of:

1. £22	**2.** £75	**3.** £42	**4.** £34
5. £124	**6.** £58	**7.** £55	**8.** £65
9. £80	**10.** £27	**11.** £46	**12.** £38

What amount will a landlord of a house actually pay to a ground landlord, after deducting Income Tax, if the ground rent is the following ?

13. £5 10*s.* **14.** £8 **15.** £4 10*s.* **16.** £6 6*s.*

Exercise 65.

Miscellaneous Examples on Chapter XV.

1. Find, from Table XVII., the total increase (to the nearest pound) in the National Debt per head of population, taking this as 45,000,000, between 1914 and 1920.

2. Calculate, using the figures of Table XVII., the total increase (to the nearest shilling) in the cost of interest, etc., on the National Debt per average family of 5, between 1914 and 1920.

3. The South African War cost 140 million pounds. What is this per head of population of the British Isles (to the nearest shilling) ?

4. Assuming that the total amount which this country will pay in pensions is twenty times the amount shown as payable for War Pensions and Civil Pensions in Table XVIII., find the total cost of these pensions per head of population (to the nearest £).

5. A grocer sells in one week 2 cwt. imported jam, $\frac{1}{2}$ cwt. cocoa, and $\frac{1}{2}$ cwt. coffee. What Customs duties have been paid on these goods ? (See Table on p. 110.)

6. A tobacconist sells in one week 1,000 boxes of imported matches, each containing 45 matches. Find the amount of Customs duties which have been paid on them.

7. What Customs duty has to be paid on one ton of tobacco ?

8. What Customs duty would have to be paid on a cargo of 1,000 tons of currants ?

9. The Customs duty on clocks and watches for 1920-21 was £781,000. Using the Customs Table on p. 110, find what value was put upon these articles.

10. The Customs duty on tea imported during 1920-21 was £16,863,000. If this tea was sold at an average price of 3*s.* 4*d.* per lb., what total sum was it sold for ? (The duty on tea for 1920-21 was 1*s.* per lb.)

11. What Estate duty is payable on an estate valued at £280,000 ? (Use Table XX.)

12. Find the Estate duty that will have to be paid on an estate valued at £2,374.

13. How much will be left after paying Death duties on an estate valued at £59,000 ?

14. What amount will remain after paying Death duties on an estate valued at £7,420 ?

15. How much Sur-Tax will be paid by a man whose income is £3,740 ?

16. Find the amount of Sur-Tax payable by a man whose income is £8,700.

17. What Income Tax is payable on a house the gross annual value of which is £45 ?

18. What Income Tax must be paid on a house the gross annual value of which is £90 ?

CHAPTER XVI

METHODS OF USING SAVINGS

90. Investments for Old Age.—The ordinary man needs to insure his life, not only to provide for his family, in the event of his early death, but also to make provision for his own old age. The wisest thing to do first is undoubtedly to secure an Endowment Insurance policy. As we saw in Chapter XI., this makes provision for his family in case he dies at an early age, while if he lives to an old age he himself will receive the sum arranged in the policy. When this money has been paid to him, he will still have to decide the best way of using it.

Let us suppose a man aged 60 or 65 to have received a lump sum from his Insurance Company. Suppose, too, that he is unable to work, and wishes to derive the maximum benefit he can from the money which has come to him.

If the sum is a large one he will probably invest it and live on the interest. In this case, when he dies, the capital will still remain untouched (unless his investments have depreciated in value), and he will leave it to his heirs.

If, however, the sum is only a small one, say two or three hundred pounds, he will need to use the capital as well as the interest in order to have enough to live on. Such a man is in a difficulty, however. He does not know how long he will live. If he lives to a very old age there is the risk of his capital becoming used up before the end of his life. The wisest thing for such a man is to use at any rate a part of his money in purchasing an *Annuity*. Any Insurance Company upon payment of a lump sum will guarantee to pay an annuity as long as the person lives.

For instance, Table XXII. shows the annuities* which four of the leading Insurance Companies guarantee to pay to men and women aged 55 and 60, for a single preliminary payment of £100.

TABLE XXII.

ANNUITIES PURCHASABLE FOR £100.

Insurance Company.	*Men.*		*Women.*	
	Age 55.	*Age* 60.	*Age* 55.	*Age* 60.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
A	7 12 4	8 16 4	6 3 3	6 18 1
B	8 2 6	9 4 6	6 10 6	7 6 0
C	7 19 2	9 3 6	6 11 8	7 5 2
D	7 6 0	8 8 10	6 2 4	6 15 8

The annuities purchasable for £500 would be 5 times those given above, those purchasable for £1,000 would be 10 times the figures in the table, and so on.

Example.—Find (to the nearest penny) the weekly income from annuities of a man aged 60 who pays £500 to Insurance Company A, and £300 to Insurance Company B.

	£	*s.*	*d.*
Annuity from "A" = 5 × £8 16*s.* 4*d.* =	44	1	8
„ „ "B" = 3 × £9 4*s.* 6*d.* =	27	13	6
Total annuity =	£71	15	2

Weekly income = £71 15*s.* 2*d.* ÷ 52 = £1 7*s.* 7*d.* (to nearest penny).

EXERCISE 66.

Using Table XXII., find the annuities which a man aged 55 can obtain upon payment of the following amounts:

1. £450 to Insurance Company A.
2. £1,150 „ „ B.
3. £700 „ „ C.
4. £250 „ „ D.

* Most Insurance Companies will now also grant annuities upon the joint lives of a man and his wife. In this case, the annuity is paid in full until the death of whichever of them survives the other.

Find (to the nearest penny) the joint weekly income from annuities of a man aged 60 and his wife aged 55, upon payment of the following amounts:

5. £200 each for the man and his wife to Insurance Company A.
6. £300 for the man and £250 for his wife to Insurance Company B.
7. £700 for the man and £500 for his wife to Insurance Company C.
8. £300 for the man and £150 for his wife to Insurance Company D.

91. Calculation of Annuities.—We must now try to understand how it is possible to calculate the annuities that an Insurance Company can afford to pay upon receipt of a single premium. In calculating the annuities the Insurance Company makes use of the "Expectation of Life" table to which we have referred before. For instance, suppose the expectation of life at a certain age is just over 10 years. The first annual payment is made a year after the purchase of the annuity, so that 10 payments will be made in all.

The Insurance Company invests the premium as soon as it is received. So by the end of the year it has gained interest. The first annual payment is then made, and what is left of the original payment is kept invested for the second year. At the end of the second year interest has again been earned, and a further annual payment is made. This process goes on for the 10 years, and if the calculations have been properly made, there is just enough money left of the original premium, together with the interest earned during the tenth year, to make up the tenth and last annual payment.

In order to calculate what the premium should be, the Insurance Company first draws up a table similar to Table XXIII., p. 121. In this table compound interest is assumed to be earned by invested money at the rate of 3 per cent. per annum. This is the usual figure assumed by Insurance Companies in their reckonings.

Table XXIII. is quite simple to understand, provided we remember what was said about compound interest in Chapter X.

The *first column* simply gives the number of years on which our calculations are based.

The *second column* tells us the sum which we should have at the end of any number of years from 1 to 20, if we invested £1 at the beginning of the period at 3 per cent. compound interest. The method of arriving at these figures was given in paragraph 47.

The *third column* introduces the idea of what is called *Present Value.*

To take an example, we see from the second column that if we

invest £1 now at 3 per cent. compound interest, we shall have £1·3439 in 10 years' time.

TABLE XXIII.

Annuity Table.

Number of Years "N."	*Sum to which £1 will amount in "N" Years at 3 per Cent. Compound Interest.*	*Present Value of £1 Payable in "N" Years, Reckoning Compound Interest at 3 per Cent.*	*Present Value of an Annuity of £1 for "N" Years.*
	£	£	£
1	1·0300	·971	·971
2	1·0609	·943	1·914
3	1·0927	·916	2·830
4	1·1256	·889	3·719
5	1·1593	·863	4·582
6	1·1941	·837	5·419
7	1·2299	·813	6·232
8	1·2668	·788	7·020
9	1·3048	·766	7·786
10	1·3439	·744	8·530
11	1·3842	·722	9·252
12	1·4258	·701	9·953
13	1·4685	·681	10·634
14	1·5126	·661	11·295
15	1·5580	·642	11·937
16	1·6047	·623	12·560
17	1·6528	·605	13·165
18	1·7024	·587	13·752
19	1·7535	·570	14·327
20	1·8061	·554	14·881

£1 is therefore called the *present value* of £1·3439 payable in 10 years' time. Of course, this is only the case if compound interest on the £1 is at the rate of 3 per cent. If the interest were at the rate of 4 per cent., £1 would be the *present value* of a larger sum payable in 10 years' time (£1·4802).

Assuming interest at 3 per cent. per annum, then since £1 = present value of £1·3439, therefore present value of £1 = £$\frac{1}{1 \cdot 3439}$ = £·744.

The third column can therefore be obtained from the second column by dividing £1 by the numbers in the second column.

It is the present value of £1 payable in any given number of years which we need to know in order to calculate the annuities which can be paid.

For instance, (*a*) £·971 is the present value of £1 payable in 1 year. So by paying £·971 now I can secure a single payment of £1 in 1 year's time. (*b*) £·943 is the present value of £1 payable in 2 years. So by paying £·943 now I can secure a single payment of £1 in 2 years' time.

Suppose we combine statements (*a*) and (*b*). Then by paying £(·971 + ·943) = £1·914, I can secure payments of £1 in 1 year's time and a second £1 in 2 years' time. In other words, £1·914 will purchase an annuity of £1 for 2 years.

The figures in the *fourth column* are therefore obtained by adding up the consecutive amounts in the third column.

Thus the present value of an annuity of £1 payable for 5 years =

							£
	Present value of £1 payable in				1 year	or	·971
+	,,	,,	,,	,,	2 years	or	·943
+	,,	,,	,,	,,	3 ,,	or	·916
+	,,	,,	,,	,,	4 ,,	or	·889
+	,,	,,	,,	,,	5 ,,	or	·863
							= £4·582

Having obtained the table it is quite a simple matter to use it, as the following examples will show.

Example I.—How much would it cost to buy an annuity of £10 guaranteed for 10 years?

Present value of annuity of £1 for 10 years = £8·530
∴ ,, ,, ,, £10 for 10 years = £85·30
= £85 6*s*.

Example II.—If I pay £100 down at the age of 60, and the expectation of life at this age is about 13 years, what annuity ought I to expect, if compound interest is reckoned at 3 per cent. per annum?

Number of annual payments = 13.
Present value of annuity of £1 for 13 years = £10·634.
∴ £10·634 will secure an annuity of £1 and £100 will secure an annuity of $£\frac{100}{10 \cdot 634} = £9 \cdot 404 = £9\ 8s.\ 1d.$

Most of the annuities given in Table XXII. were round about

this figure. Three of them were rather less, because there are certain expenses to be met by the Insurance Company in connection with the payment of the annuities, and these have to be paid for by the person to whom the annual payments are made.

EXERCISE 67.

Using Table XXIII., what should it cost (to the nearest shilling) to buy the following annuities, reckoning compound interest at 3 per cent. ?

1. £80 per year for 12 years.
2. £60 ,, ,, 15 ,,
3. £100 ,, ,, 14 ,,
4. £120 ,, ,, 9 ,,
5. £50 ,, ,, 20 ,,
6. £70 ,, ,, 16 ,,

If compound interest is reckoned at 3 per cent. per annum, what annuities ought a man to expect in the following cases ?

7. If he pays £700 at the age of 61, his expectation of life being about 12 years.
8. If he pays £500 at the age of 64, his expectation of life being about 11 years.
9. If he pays £1,000 at the age of 65, his expectation of life being about 10 years.
10. If he pays £400 at the age of 57, his expectation of life being about 15 years.

92. **Buying a House.**—A man often uses his savings to enable him to buy a house. A man who wishes to buy a house can usually obtain from a Building Society the loan of a part of the purchase money. Usually about one-half of the value of the house can be borrowed in this way. The money is generally repaid to the Building Society by monthly payments spread over a number of years. These monthly payments include the interest. The problem is similar, therefore, to the method of repaying municipal loans dealt with in paragraph 78. The only difference is that usually a higher rate of interest is required—up to 6 or 7 per cent. per annum.

Thus Table XXIV. is similar to Table XV., except that it gives the annual amounts required to repay a loan of £100 for higher rates of interest.

Example.—Find (to the nearest penny) what monthly sum will have to be paid to a Building Society to repay a loan of £300 in 20 years, interest being reckoned at 7 per cent. per annum.

Annual payment = £9 7*s.* 1½*d.* × 3 = £28 1*s.* 4½*d.*
Monthly payment = $\frac{1}{12}$ of £28 1*s.* 4½*d.* = £2 6*s.* 9*d.*

TABLE XXIV.

ANNUAL PAYMENTS OF PRINCIPAL, COMBINED WITH INTEREST, REQUIRED TO PAY OFF A LOAN OF £100.

Years.	*6 per Cent.*	*7 per Cent.*
	£ *s.* *d.*	£ *s.* *d.*
10	13 8 10½	14 1 4
20	8 13 1½	9 7 1½
30	7 4 6½	8 0 2½

EXERCISE 68.

Using Table XXIV., find (to the nearest penny) what monthly sum will have to be paid to a Building Society to repay the following loans:

1. £400, repayable in 10 years, at 6 per cent.
2. £250 „ 20 „ 6 „
3. £500 „ 10 „ 7 „
4. £700 „ 20 „ 7 „
5. £800 „ 30 „ 6 „
6. £900 „ 30 „ 7 „

EXERCISE 69.

1. Using Table XXII., find (to the nearest penny) the weekly income of a man who pays £800 for an annuity to Insurance Company A at the age of 60.

2. What weekly income (to the nearest penny) will a man receive from an annuity purchased for £1,000 from Insurance Company C, at the age of 60? (See Table XXII.)

3. A woman pays £500 to Company D in Table XXII. for an annuity at the age of 60. What will her weekly income from the annuity be (to the nearest penny)?

4. How much should it cost to buy an annuity of £90 per year for 13 years, reckoning interest at 3 per cent.? (Use particulars in Table XXIII. for Examples 4 to 7.)

5. What should be the cost of an annuity of £80 per year for 15 years, reckoning interest at 3 per cent.?

6. What annuity ought I to receive for a cash payment of £500 at the age of 53, the expectation of life being 17 years, and interest being reckoned at 3 per cent.?

7. What annuity ought I to receive for a cash payment of £800 at the age of 50, the expectation of life being 19 years, and interest being reckoned at 3 per cent.?

8. What monthly sum (to the nearest penny) would have to be paid to repay a loan of £500 to a Building Society in 20 years, reckoning interest at 6 per cent.? (See Table XXIV.)